THE VETERINARY JOURNAL

AND

Annals of Comparative Pathology.

OCTOBER, 1894.

THE VIRULENCE OF TUBERCULOUS FLESH.

BY M. E. LECLAINCHE, PROFESSOR AT THE VETERINARY SCHOOL OF TOULOUSE, FRANCE.

ARE the muscles of tuberculous animals virulent? Is tuberculous flesh dangerous as food for man? These grave questions have been the object of numerous experimental investigations, and they have been several times discussed by learned congresses; yet their solution, still uncertain, remains enveloped in vague and uncertain formulæ.

Here we shall find the essential elements of the process—that is to say, an impartial *exposé* of the results derived from the experiments. All the documents now referred to are no doubt known, but certain of them are so disfigured by faulty translation or inexact copying that it is difficult to recognise them.

In the simple examination of the logically grouped facts, the reader will perhaps find the elements of a conviction that would not otherwise be so readily arrived at.

The information acquired with regard to the virulence of the muscles of tuberculous animals can only be applied to one species of animal, and it is naturally indicated to collect into one group all the experiments which concern each one of them. In this way we shall examine the virulence of the muscles in bovines, sheep, goats, pigs, fowls, and man.

It is evident, on the other hand, that the virulence of the muscular tissue is closely related to that of the blood, for not only is this being constantly filtered by the muscle, but there always remains a notable quantity of it in the capillaries,

even in animals which have been completely bled.* For this reason reference must be made here to the few experiments regarding the virulence of the blood.

1. Bovines.

A. Virulence of the Blood.

Semmer,† in 1876, reported a first series of experiments he made. The animals he experimented upon were young pigs and sheep, and these he inoculated beneath the skin and in the veins with the blood derived from a cow affected with pulmonary and pleural tuberculosis. Seventeen of thirty animals survived, and of this number sixteen—*ten pigs* and *six sheep*—were found to be tuberculous; only one sheep remained free from the disease.

These results would be very alarming if an analysis of Semmer's experiments did not show that the facts related were not sufficiently precise to warrant a conclusion, and if grave causes of error were not made evident.‡

In 1880, Galtier§ obtained two positive and nine negative results from inoculations into rabbits, by hypodermic injection, of blood from phthisical cows condemned in the slaughter-house. "Since then," he says, "I have obtained almost analogous results, except that, in certain instances, one or two rabbits out of four became tuberculous, while two or three others remained unaffected, though inoculated in the same manner and with the same dose of blood. More recently I have succeeded in developing the malady by injecting beneath the skin or into a vein some drops of blood from the heart of two phthisical cows seized at the abattoir."

In 1890, Bang‖ furnished an important contribution on the same subject. "From twenty *extremely tuberculous* cows I have inoculated thirty-eight rabbits and two guinea-pigs in

* According to Bollinger, one-third of the total mass of the blood remains in the carcass of animals killed in the ordinary way in slaughter-houses.

† Semmer. "Tuberculose und Perlsucht." *Deutsche Zeitschrift für Thiermedicin*, 1876, vol. ii., p. 209, and *Virchow's Archiv*, 1880, Vol. lxxxii., p. 546.

‡ It is impossible to discern the conditions under which the experiments reported were made. The author says that his animals were inoculated with the *milk and the blood* of the tuberculous cow, some beneath the skin and others into the veins, with a quantity of matter varying from 1-40th of the total mass of the blood of the inoculated (?). In addition to the criticisms formulated by Virchow in the *Archiv* (p. 500), we may remark that the results almost constantly obtained in an animal so refractory as the sheep are sufficient to justify all doubts. It ought to be remembered that the experiments date from 1875, and therefore all the criticising now so easily made should not tend to injure the capable Russian experimentalist.

§ Galtier. "Dangers de l'Emploi des Sangs Frais. *Congrès de la Tuberculose*, 1888, p. 147.

‖ Bang. Le Danger Supposé du Lait et de la Viande des Animaux Tuberculeux. *Congrès Internationale d'Hygiene de Londres*, 1891.

the peritoneum, with defibrinated blood, the dose varying in the majority of the experiments between 10 and 28 cubic centimetres.

"The results were negative in eighteen instances and positive in two. And of these two, only one of the two rabbits inoculated from one of them showed tuberculous lesions which were otherwise very insignificant. The cow from which, in the other instance, virulent blood had been obtained, was attacked with acute miliary tuberculosis that became developed after the injection of tuberculine. Three weeks previous to this injection, the blood of this same cow was shown to be inoffensive It must be added that among these negative cases were found several of acute miliary tuberculosis."

McFadyean* has investigated the virulence of the blood in two cows affected with generalised tuberculosis; one of these had tuberculous lymphatic tumours of considerable size in the parotideal region and in front of the shoulder; the other had extensive tuberculosis of the lungs and bronchial glands. The blood was obtained from the jugular vein, due precautions having been observed with regard to asepsis.

In the first experiment, each of three rabbits received 6·8 cubic centimetres of defibrinated blood in the peritoneal cavity. When killed forty-eight days afterwards, they were found to be free from tuberculosis. In the second experiment, two rabbits received 5 cubic centimetres each of defibrinated blood into the peritoneum. Forty days subsequently, when killed, no tuberculous lesions could be discovered.

Bollinger and Hagemann† inoculated ten guinea-pigs with the blood of cows affected with more or less extensive tuberculosis (four cases very bad, two moderately so). The blood was collected with all possible precautions at the moment of slaughter and immediately inoculated, each guinea-pig receiving 2 cubic centimetres of blood. Of the ten so inoculated, *nine remained healthy*, but the tenth was found to be very tuberculous seven weeks afterwards, tubercles being discovered in the liver, spleen, and abdominal and lymphatic glands; this animal had been inoculated with the blood of one of the most severely affected cows, but which was in middling condition, and the flesh of which had been sold as human food (*Freibank*).

From the preceding experiments it is possible to deduce the

* McFadyean. The Virulence of the Blood and Muscles in Tuberculosis. *The Journal of Comparative Pathology and Therapeutics*, 1892, Vol. v., p. 22.

† Bollinger. Ueber die Infectiosität des Blutes Tuberculoser Rinder. *München Medic. Wochenschrift*, 1893, No. 50, p. 765. A. Hagemann. *Inaugural Dissertation*, Munich, 1893.

following conclusion :—*The blood of tuberculous bovines may be virulent, but this virulence is exceptional.*

B. VIRULENCE OF THE FLESH.

The existence of virulence in the flesh is sought to be demonstrated by two very different methods, with regard to severity of test—these are *inoculation* and *ingestion.*

1. *Inoculation.*

In 1880, Toussaint* produced rapid tuberculisation in a five months' old pig, which had been inoculated beneath the skin with 2 centrimetres of juice obtained from the ischio-tibial muscles of a tuberculous cow.

Galtier†, in a long series of experiments extending from 1879 to 1881, realised transmission in two lots of fifteen guinea-pigs and sheep, by inoculating them subcutaneously with the juice expressed from tuberculous flesh, obtained from cattle seized at the Lyons abattoir. The inoculated rabbits received 1 cubic centimetre of the juice, and the sheep 8 cubic centimetres.

Nocard,‡ in 1885, published an important series of researches with regard to the virulence of muscle juice. "All the experiments were made under the same conditions. The muscle juice was obtained by the expression of a piece of *cardiac muscle* excised from the interventricular septum by means of flamed forceps and scissors, carefully keeping the heart from contact with the tuberculous organs or fluids flowing from them. After each experiment the flesh-press was diligently washed, and submitted to an oven where it was exposed for an hour to a temperature of 180° to 200° Cent.

Chauveau and Arloing§ on two occasions endeavoured to ascertain if the muscles were virulent. In the first series, the muscle juice was derived from a cow affected with extensive peritoneal tuberculosis. "Fragments of muscle were cut out of the mass by a red hot cautery, and these were afterwards divided with a flamed scalpel, the pulp being taken by scraping the centre of these scraps, and then squeezing the juice from it."

Twenty guinea-pigs received two drops of this juice beneath their skin, and they were killed forty-three days afterwards,

* Toussaint. Sur la Transmissibilité de la Tuberculose. *Académie des Sciences.* June 8th, 1880.

† Galtier. Traite des Maladies Contagieuses, 1st Edition, p. 575.

‡ Nocard. Recherches sur l'Inoculabilité du Suc Musculaire et du Lait Cru des Vaches Tuberculeuses. Bulletin de la Soc. Centrale de Méd. Vétérinaire, 1885, p. 49.

§ Veterinary Congress of 1885.—*Comptes Rendus*, p. 528.

when *two were discovered to be tuberculous*, the other eighteen not showing anything of the disease.

"In every instance the diagnosis was confirmed by finding Koch's bacillus.

"All the inoculations were made into the peritoneal cavity, with from ten to twenty drops of the fluid."

Fifteen guinea-pigs were inoculated with the muscle juice from fifteen tuberculous cows. Among these were six in a state of marasmus and completely phthisical, showing extremely serious lesions, which often extended to every part of the body. Four others were in fair condition, though affected with generalised tuberculosis. Another, in very good condition, had succumbed to a subacute attack of pulmonary tuberculosis; at the necropsy there were found old foci in the mesenteric glands and mammæ.

None of the fifteen inoculated rabbits were infected.

The second series of experiments was carried on with the sublumbar muscles of a bull affected with pulmonary tuberculosis. *Six guinea-pigs* were inoculated in the same manner as the others, and in forty-seven days they were sacrificed; *none of them were tuberculous.*

In 1888, Nocard* published the results of a second series of experiments. Ten cows affected with *generalised tuberculosis* were procured. The majority of these had been seized at the abattoirs of Villette and Grenelle, the others having been purchased for the use of the students at the Alfort School in their operative instruction. In each case the diagnosis was confirmed by a microscopical examination, and by inoculating guinea-pigs with the tuberculous products.

"The portions of muscle employed were always taken from the centre of the large adductor of the thigh, by means of flamed instruments. The muscle-juice was obtained by using a meat-press, which was washed every time it was used, then sterilised for two hours at a temperature of 200° in an oven.

"Each time four guinea-pigs were inoculated by injecting 1 cubic centimetre of flesh-juice into the peritoneum. The animals were kept in metal cages, which were either new or had been washed with boiling water and then with carbolised or cresylised water."

Of the *forty guinea-pigs inoculated*, only one was infected, under the following conditions:—

May 3rd, 1888. Cow, five years old; seized because of generalised tuber-

*Nocard. Congrès pour l' Etude de la Tuberculose. First Session, 1888. *Comptes Rendus*, p. 53.

culosis. Lungs, liver, lymphatic glands, pleura and peritoneum full of tubercles.

Inoculated four young guinea-pigs, which weighed collectively 1,065 grammes.

On July 3rd, one of the guinea-pigs *died in a very emaciated condition;* there was intense tuberculosis of the lymphatic glands, the spleen, liver, and lungs.

On July 22nd, the three remaining guinea-pigs were fat and vigorous, and together weighed 1,520 grammes. Two were sacrificed by decapitation; no trace of tuberculosis.

Peuch * tested the virulence of the muscles of a cow that had *succumbed to generalised tuberculosis*. The juice was inoculated beneath the skin of *three rabbits*, the dose being 2-10ths of a cubic centimetre for each. They all became tuberculous.

Galtier † published a new series of experiments made with the muscles of seven cows affected with extensive tuberculosis, and the flesh of which had been seized. In a total of sixteen guinea-pigs and two rabbits which had been inoculated beneath the skin, in the peritoneum, or in the veins with a quantity of muscle-juice varying from two to twelve cubic centimetres, *only four guinea-pigs* were infected.

In one experiment the gluteal muscles were not virulent, though the juice from the muscles of the shoulder of the same animal proved to be infective.

Veyssiere and Humbert ‡ inoculated *two rabbits* in the peritoneum with 1 cubic centimetre of the juice extracted from the psoas muscles of a tuberculous cow. *The two animals were infected.*

Gratia and Lienaux§ performed the two following experiments:

1. "A small quantity of flesh juice obtained by the simple expression of muscle, and without the addition of water, was injected into the anterior chamber of the eye of the guinea-pig. The same animal was also inoculated by a cutaneous incision in the thigh. Three months afterwards the creature was killed, and then it was found to be perfectly healthy.

2. "Three grammes of the muscle juice derived from a tuberculous cow, were injected into the abdominal cavity of a guinea-pig. Two months subsequently the animal appeared to be in good health, and at its autopsy not a trace of tuberculosis was discernible."

Stubbe‖ inoculated the juice obtained from the flesh of three cows suffering from generalised tuberculosis. In each instance a rabbit received two cubic centimetres of this juice beneath

Peuch. Congrès de la Tuberculose, 1888. *Comptes Rendus*, p. 74.

† Galtier. Congrès de la Tuberculose, 1888, p. 76.

‡ Veyssiere. *Ibid.*, p. 97.

§ Gratia and Lienaux—"Contribution a l'Etude de la Virulence de la Viande des Sujets Tuberculeux." *Annales de Méd. Vétérinaire*, 1888, p. 640.

‖ Stubbe. *Congrès Internationale de Méd. Vétérinaire*, 1889, p. 455.

the skin. *Two rabbits died tuberculous*, and a third remained exempt.

Kastner * inoculated *sixteen rabbits* with muscle juice, obtained from twelve cows whose flesh had been sold for human food; they were from eighteen months to ten years old, and had suffered from tuberculosis in various degrees, several of them showing generalised lesions.

"On each occasion there was obtained a kilogramme of meat without bone, taken from various parts of the body, and the juice was prepared with the following precautions: The dishes for the reception of the flesh were disinfected with a 1 per 1,000 solution of corrosive sublimate, then washed in dilute alcohol; the instruments were immersed in a 5 per cent. solution of carbolic acid, and the knives passed through flame. The glasses, clothes and other apparatus were also sterilised. The flesh was cut in very thin slices, which were rolled in slightly damped linen, and then submitted to pressure. From two pounds of flesh there was obtained about 50 cubic centimetres of juice. This juice was injected into the peritoneum of the guinea-pigs."

The animals so inoculated were kept in perfectly clean places.

In all the cases the results were negative, and this warrants the opinion "that if infection by the flesh of tuberculous bovines is possible, even though there is no tubercle in the muscles, this virulence must be very rarely observed."

Perroncito † summarily reports a considerable number of experiments made with the flesh of cattle affected with tuberculosis in various degrees. "*More than two hundred rabbits and as many guinea-pigs* were inoculated beneath the skin or into the peritoneal cavity, with the juice of the flesh. These animals were killed at the end of a month and a-half, two months, and three months after inoculation, *and no trace of tuberculosis could be detected.*"

McFadyean's ‡ investigations were carried out with the muscles of fourteen cattle affected with generalised tuberculosis involving the viscera or serous membranes, and which were found in the slaughter-houses. The experimental arrangements are very minutely described. The flesh was in every instance normal in appearance, and was removed from regions in which there were no lymphatic glands—generally

* W. Kastner.—"Experimentelle Beiträge zur Infectiosität des Fleisches Tuberculoser Rinder. *Münch. Medicin. Wochenschrift*," 1889, pp. 583, 600.

† Perroncito. Second Congress on Tuberculosis, 1891. *Comptes Rendus*, p. 308. Centralblatt für Bakteriologie, 1892, Vol. xi., p. 429.

‡ *Loc. cit.*, p. 25.

from the muscular mass in the gluteal region. The portions so removed from animals in good condition contained a considerable proportion of intermuscular fat. In all the experiments except the first, the superficial parts of the flesh were rejected, because of their having possibly been soiled by the hands or knife of the butcher. The instruments employed were previously sterilised at a dry temperature of 160° or in a Papin's digester at 120°. The flesh was coarsely chopped up, enveloped in a cloth previously sterilised in the stove, then submitted to the press, which had been also sterilised. As soon as they were inoculated, the animals experimented upon were completely isolated from each other in new or entirely sterilised cages. The muscle-juice was also tested as to its virulency by ingestion. The flesh of the fourteen cattle was tested by inoculation in the following manner:—

By subcutaneous inoculation with one cubic centimetre of juice	8 guinea-pigs and 2 rabbits.
By intraperitoneal inoculation with one cubic centimetre of juice	3 guinea-pigs and 8 rabbits.
By intraperitoneal inoculation with three cubic centimetres of juice ..	2 rabbits.

These animals were killed in from twenty-three to one hundred and twenty-one days after the inoculations, *and no trace of tuberculosis was found in any of them.*

Loncachevitch * inoculated six guinea-pigs subcutaneously with an emulsion obtained by triturating 100 grammes of flesh from tuberculous cows in three cubic centimetres of a 0·6 solution of common salt. Loncachevitch asserts that he never could succeed in practising intraperitoneal inoculation with the flesh juice alone in consequence of its undergoing putrefaction in the abdominal cavity.

Experiment 1.—*Two guinea-pigs* received each one cubic centimetre of the emulsion subcutaneously. When killed two months afterwards, the result was found to be negative.

Experiment 2.—*A guinea-pig* received in the peritoneal cavity one cubic centimetre of the emulsion, and another 1·5 cubic centimetre, subcutaneously. Killed at the end of two months. Result negative.

Experiment 3.—*Two guinea-pigs* received subcutaneously at the flank, one 4 cubic centimetres, the other 5 cubic centimetres of the emulsion. Both were seriously ill for 4 or 5 days, and did not recover for a month and a-half. Killed after two months, they were discovered to be tuberculous, and there was an abscess at the seat of inoculation.

This brief analysis will suffice to show that these latter experiments possess a very relative value.

* Loncachevitch. *Sur la Tuberculose chez les Animaux.* Thèse de Saint Petersbourg, 1893 (in Russian).

2. *Ingestion.*

The experiments of Gerlach* were performed on the pig, rabbit and dog. They were briefly as follows :—

Experiment 48.—*Two young pigs*, eight weeks old, received during several days ten pounds of chopped flesh derived from a tuberculous cow. They were killed in two months afterwards. No. 1 was healthy ; No. 2 was slightly infected, there being some cheesy foci in the lymphatic glands of the neck and a few miliary tubercles in the lungs.

Experiment 49.—*Two pigs*, ten weeks old, received in nine days ten pounds of tuberculous flesh which had been kept fresh in ice. Killed at the end of six weeks, No. 1 was healthy, and No. 2 infected, there being recent tubercles in the lymphatic glands and tubercles in the lungs and on the pleura.

Experiment 50.—*Two pigs*, four weeks old, received ten pounds of tuberculous flesh in eight days. When No. 1 was killed in six weeks, it was found to be healthy, but No. 2 on being destroyed at the end of the seventh week was discovered diseased, there being tubercles in the pharyngeal lymphatic glands and in the lungs.

Experiment 51.—A *rabbit* received the same kind of flesh for some days without becoming infected.

Experiment 52.—A *dog* was fed for a week upon the raw flesh of the same cow. When killed two months afterwards it was not infected.

In experiment 53 a young pig received at the same time milk and flesh from tuberculous cows. The positive result need not be detailed here.

Experiments 54 and 55 deal with the ingestion of the flesh of a tuberculous sheep.

Experiment 56.—*Four rabbits* received in two days a piece of flesh about the size of a fowl's egg obtained, for two of them, from the intercostal spaces, beneath the pleura, and for the other two, from the muscles of the thigh of a tuberculous cow. They were free from tubercles when killed four months afterwards.

Experiment 58.—A *young pig* received during eight days, half a pound of flesh from a very tuberculous cow. *Three dogs* were fed for fourteen days on the same flesh. Killed two months afterwards these animals were found healthy.

Experiment 59.—Ingestion of the flesh of a tuberculous pig.

Experiment 60.—*Four rabbits* received in two days five grammes of flesh from a tuberculous cow, and on being sacrificed at the end of a month no disease could be discovered.

Resumé.—Of *nine rabbits* which had ingested the flesh of tuberculous cows, *none were* infected.

Of *seven pigs* submitted to ingestion, three were infected, and *four* resisted infection.

Gerlach came to the conclusion that the flesh of tuberculous animals is infectious, but to a much less degree than the masses of tubercular matter.

Semmer† fed "more than a *hundred dogs*" with tuberculous flesh, without observing a single positive result.

* Gerlach. Ist das Fleisch von Perlsuchtigen Rindern und Uberhaupt von Tuberkelkranken Thieren als Nahrungsmittel für Menschen zu Verwerfen? *Archiv für Thierheilkunde*, 1875, Vol. I., p. 1.

† Semmer. Loc. cit.

Nocard* fed eleven cats on flesh from tuberculous animals.

Experiment 1.—*Four cats*, twenty-six days old, in three days consumed 2,500 kilogrammes of raw chopped meat from a cow affected with generalised tuberculosis. When killed in three months the result was found to be *negative.*

Experiment 2.—*Three cats*, five weeks old, received the flesh of a cow affected with generalised tuberculosis. Each ingested nearly a kilogramme in two days. Killed after five months. *Result negative.*

Experiment 3.—*Four cats*, a month old, received in four meals during the course of a month, two kilogrammes of raw flesh obtained from tuberculous cows. *Result negative.*

Peuch† gave two pigs, two months and a-half old, 16 and 18 kilogrammes of tuberculous flesh in ten days. When one of them was killed at the end of seventy days, only some solitary tubercles were found in the liver and in the subglossal and mesenteric lymphatic glands.

In 1890, experiments were instituted in England by the Veterinary Department of the Ministry of Agriculture.‡ These were made in three series by different experimenters, and without any predetermined programme. The first series was made at Harrow; the second at Denham, under the direction of Professor Brown; and the third at Edinburgh, by Professor McFadyean.

EXPERIMENTS AT HARROW.—*Eight rabbits* and *four guinea-pigs* were fed with flesh from tuberculous cows. The results are summed up as follows:—

Nos.	Animals.	Matters ingested.	Duration of the experiments. Days.	No of Feeds.	Result.
1	Rabbits	Flesh of shoulder of a cow ..	5	6	Positive
2	,,	,, ,,	5	7	,,
3	,,	,, ,,	2	4	,,
4	,,	,, ,,	2	4	,,
5	,,	,, ,,	2	3	Negative
6	,,	,, ,,	2	3	,,
7	,,	Tuberculous diaphragm after scraping off the pleura ..	3	3	Positive
8	,,	,, ,,	3	4	,,
9	guinea-pig	Diaphragm of a cow with tuberculous lungs and pleura ..	3	4	Negative
10	,,	Flesh from a tuberculous cow	3	6	,,
11	,,	Diaphragm of a tuberculous cow	3	4	Positive
12	,,	Flesh from a cow with tuberculous lungs and pleura ..	5	9	?

EXPERIMENTS AT DENHAM.—From November 10th, 1890, nine guinea-pigs, divided into three separate lots, received in eight days nine feeds, composed of oats and bran mixed with a dessert spoonful of finely chopped flesh from tuberculous

* Nocard. First Congress on Tuberculosis, 1888. *Comptes Rendus*, p. 57.

† Peuch. Idem, p. 74.

‡ "Annual Report of the Veterinary Department for the Year 1890, p. 8—19."

cattle, for each cage. On January 2nd, an animal of each lot was killed; the three were *free* from tubercle.

From the 3rd to the 10th January, 1891, the remaining six animals received in their food juice from the flesh of tuberculous cows.

From the 14th to the 22nd January, the six guinea-pigs had died or been killed, and all were tuberculous. Two test guinea-pigs, which had not received tuberculous matters, were killed at the commencement of February, and found perfectly healthy.

(*To be continued.*)

REMARKS ON HOG CHOLERA AND SWINE PLAGUE.*

BY WILLIAM H. WELCH, M.D., PROFESSOR OF PATHOLOGY, JOHNS HOPKINS UNIVERSITY, AND A. W. CLEMENT, V.S. (FROM THE PATHOLOGICAL LABORATORY OF THE JOHNS HOPKINS UNIVERSITY.)

OUR observations of hog cholera and swine plague relate mostly to these diseases as they have occurred in Maryland, particularly in the vicinity of Baltimore, since the year 1887, although we have examined cases, specimens, and cultures, also, from various other parts of the country. Our work on this subject began soon after the publication of the discovery of the germs of hog cholera and of swine plague by Salmon and Theobald Smith, and has been carried on independently of that of the Bureau of Animal Industry. Although the publications of this Bureau have, to a large extent, anticipated the publication of our results, nevertheless the conclusions and the manner of their presentation by the Bureau of Animal Industry, have been subjected to so much hostile criticism (most of it, in our opinion, uncalled for and unjust), and there has ensued so much confusion as to this whole subject, that it seems important to present additional and independent observations of these epizootic diseases of swine in this country.

Our results are in large measure confirmatory of those reached by the Washington Bureau. As will appear from this paper, there are, however, some points as to which we have arrived at different conclusions from those of the Bureau, and we believe that we have added some new facts of importance. We also claim to have placed upon a firmer basis, by the observance of stricter precautions in guarding

* Read at the First International Veterinary Congress of America, held in Chicago, Ill., in October, 1893.

against possible error, some of the conclusions reached by the Bureau upon what we regard as insufficient evidence.

Our studies have extended over several years, and have been made upon more than twenty herds of swine in different epizootics. On this occasion we propose to present the more important general results of our investigations, especially as to points which may be considered not wholly settled, and to leave the presentation of our protocols and the full details to a later monograph.

We have adopted the nomenclature of the Bureau of Animal Industry, and understand by the hog-cholera bacillus the micro-organism which was first clearly described by Theobald Smith, and which is called by this name in the various reports and publications of the Bureau since their third report for the year 1886 (published in 1887). By hog cholera we understand the disease in swine caused by this bacillus. We employ the name swine-plague bacillus for the micro-organism so designated in the reports of the Bureau of Animal Industry since that for 1886, and by swine plague we understand the disease caused by this bacillus.

The nomenclature of the epizootic diseases of swine has become so confusing that it is difficult for one not familiar with the various steps in the development of our knowledge of these diseases, and with the varying usage of different writers, to pick his way intelligently through the recent literature of this subject. In each country where hog cholera occurs, different names are used for it. In England it is generally called swine fever, and by Klein, also, pneumo-enteritis of swine; in Denmark and Sweden, swine pest (Svinpest) and swine diphtheritis (Svinediphteritis), and in France, pneumo-enteritis of swine (pneumo entérite du porc), and lately the American name, hog cholera, has also been used in France. Some confusion, particularly in the minds of some German writers, and excusably so, has resulted from the fact that the disease called hog cholera by the Bureau of Animal Industry, and by veterinarians in this country, is called by F. Billings, swine plague. In German writings the name swine plague seems to be more generally employed to designate the American hog cholera than is the latter name. We venture to suggest that if German writers in this respect would conform to American usage and use the name hog cholera when speaking of the American disease, some confusion would be avoided.

The affection called swine plague by the Bureau of Animal Industry since the report for 1886 (in the report for 1885 this

name was given to hog cholera), and by us, was for a time not admitted to exist by F. Billings, and is now accepted by him only as a complication of hog cholera of relatively slight importance. Swine plague seems to be identical with the German Schweine-seuche, although we do not consider this identity, for reasons which will be stated later, as settled beyond all doubt. It has been designated, also, infectious pneumonia of swine, and is regarded by the Bureau of Animal Industry as an infectious pneumo-enteritis. The disentanglement of the two diseases, hog cholera and swine plague, and still more of the two micro-organisms, the hog-cholera bacillus and the swine-plague bacillus, as regards their relations to each other and to the bacteria isolated from swine epizootics in Europe, and even as to their relation to swine diseases in this country, has been rendered difficult partly in consequence of difficulties inherent in the bacteriological study of these diseases, but largely from imperfections in these bacteriological studies, both in this country and in Europe, and also from ill-considered and confusing writings by more than one contributor to the literature of these subjects.

We do not consider that the names hog cholera and swine plague are either of them particularly fortunate designations, but usage controls nomenclature in medicine as well as in ordinary speech, and we believe that it would add still more to existing confusion were we to invent or adopt other names which are little likely to supplant those in ordinary use. Some consensus of opinion is requisite in securing the employment of new terms. We beg to suggest that an authoritative expression of opinion by the United States Veterinary Association as to the best nomenclature of the epizootic diseases of swine would be useful, especially if in this matter the Association would act in co-operation with foreign societies and authorities, so as to secure a greater degree of uniformity in international usage. Our understanding of these diseases is now sufficiently complete to justify such an undertaking.

We shall give, in the first place, a brief summary of the more important lesions of hog cholera which we have observed. The possible anatomical lesions of hog cholera are so manifold that a large experience is necessary to render one practically familiar with all of them. Of these lesions, the so-called "buttons" in the intestine are unquestionably the most characteristic. These buttons are elevated, circumscribed, round or oval areas of necrotic inflammation, of firm

consistence, of yellow, yellowish-black, or black color, often presenting an appearance of concentric rings, and involving the mucous and submucous coats, and sometimes all of the coats of the intestine. They are sufficiently familiar to the members of this Association.

Scarcely less common, but much less characteristic, than the buttons are diffuse and circumscribed superficial necroses, and diffuse and circumscribed diphtheritic inflammation of the intestinal mucosa. Ulcers, hæmorrhages, hyperæmia, follicular swellings, and catarrhal inflammation of the intestines are common. The intestinal lesions affect especially the large intestine, being often, although not invariably, most intense near the ileo-cæcal valve. They may be limited to the large intestine, but it is not rare for the small intestine and stomach to be similarly affected.

Necrotic areas similar to those called "buttons" may occur in various parts of the body beside the intestine and stomach. We have observed them repeatedly on the pharynx, the tonsils, tongue, gums, lips, other parts of the buccal mucosa, the nasal mucous membrane, conjunctivæ, gall-bladder and bile ducts (where, indeed, they are common), præputial sac, vagina, and on various parts of the integument. They are characterized by essentially similar histological appearances in all these situations - an exudate of fibrin and leucocytes, proliferation of the fixed cells, capillary thrombosis in an early stage, followed by speedy coagulative necrosis, with much nuclear fragmentation of the exudative and tissue cells.

Redness of the skin, particularly of the belly, inside of the thighs, and about the ears, is common, but not constant.

Swelling of the lymphatic glands, especially of the inguinal, mesenteric, retro-peritoneal, and bronchial, sometimes of all of the lymphatic glands of the body, is common in acute cases, but not constant. This swelling is often accompanied by hæmorrhages into the glands and foci of necrosis, sometimes visible to the naked eye, sometimes revealed only by the microscope, these changes giving a variegated, mottled appearance to the glands.

Small yellowish, or yellowish-white, or reddish foci of necrosis are common in the liver, both macroscopic and microscopic.

The condition of the spleen is variable; it may be unaffected or swollen, firm or soft, and contain fibrinous thrombi or, rarely, infarcts or hæmorrhages.

An interesting change, hitherto overlooked, is the

occasional occurrence of hyaline thrombosis of the renal capillaries, both glomerular and intertubular. When this condition is well marked, there are albuminuria and even anuria, and it is impossible to force more than a minimal quantity of injecting fluid into the renal vessels. The hyaline stains like fibrin with Weigert's fibrin stain, and is evidently closely allied to fibrin. Sections of such a kidney, stained with Weigert's fibrin stain, look almost as if the blood-vessels had been injected artificially with Berlin blue. This thrombosis may be associated with little alteration of the tubular epithelium, or with or without the thrombosis there may be fatty degeneration of the epithelium, genuine diffuse nephritis, and hæmorrhages in the kidney.

Pyelitis, usually hæmorrhagic in character, and hæmorrhages into the mucous membrane of the bladder, we have repeatedly observed. Blood-clots may be found in the renal pelvis. General fibrinous pleurisy may occur. Diffuse peritonitis we have observed only in hog cholera complicated by the presence of other bacteria.

It is the opinion of the Bureau of Animal Industry that pneumonia is not a lesion which belongs to uncomplicated hog cholera, although some broncho-pneumonia is admitted to be sometimes present. Various types of pneumonia are found in many pigs dead of hog cholera. In the great majority of our cases strongyles were present in the bronchi, and foci of broncho-pneumonia could often be referred to their presence. There were, however, observed in many cases larger or smaller areas of hepatisation, often partly necrotic, and of types which cannot be referred to the presence of strongyles. In a large proportion of these cases the swine-plague bacillus was present, with or without coincidence of the hog-cholera bacillus, in the lungs, and as the swine-plague bacillus can be shown experimentally to be capable of producing pneumonia, these cases cannot be adduced in support of the view that the hog-cholera bacillus alone may cause pneumonia. We have, however, observed some cases of pneumonia not referable to strongyles, in which the hog-cholera bacillus was present alone in the lungs, and as we possess experimental evidence, as will be explained later, that the hog-cholera bacillus may produce pneumonia in swine, we are of the opinion that pneumonia may be a lesion of uncomplicated hog-cholera. This pneumonia may be associated with fibrinous pleurisy, also referable to the hog-cholera bacillus.

Fatty degeneration of the heart may occur in hog-cholera.

Acute and chronic endocarditis and myocarditis are rare lesions which we have observed.

In not a few acute, and in some chronic cases, ecchymoses are so numerous in the skin, mucous and serous membranes, and in the viscera, that a hemorrhagic type of the disease may properly be distinguished. Even diffuse hæmorrhages may occur, particularly in the connective tissue around the kidney. Acute cases may occur of a septicæmic type without intestinal lesions.

Although a distinction between acute and chronic hog cholera is in many cases useful and appropriate, there are so many transitional types of the disease that it should be understood that there are no sharp dividing lines between acute and chronic cases.

We have had opportunity to study the process of repair of the intestinal lesions in pigs which have partly or wholly recovered from natural and experimental hog cholera, but we shall not take this opportunity to describe these interesting reparative changes.

The greater our experience in the bacteriological study of hog cholera became, the more convinced were we of the importance of completeness in the bacteriological examination of each case. To obtain thoroughly trustworthy and satisfactory results we consider it important in each case to make cover-slip preparations and cultures from the various organs of the body, especially from the lungs, spleen, heart's blood, kidney, liver, lymphatic glands (particularly the mesenteric), intestinal lesions and inflammatory exudates elsewhere if present, and also to inoculate mice or rabbits with bits of these organs and lesions. Such an examination takes much time, but a few cases carefully studied in this thorough manner are worth more than many cases imperfectly studied.

Without such complete examination it will often happen that one cannot be sure that other micro-organisms, particularly the swine-plague bacillus, were not present in some of the internal viscera, together with the hog-cholera bacillus. The hog-cholera bacillus may be present in such small number and so limited in distribution that it is likely to be overlooked unless all of the parts named are examined both by cultures and by inoculation of animals. It is often necessary to inoculate the culture tubes with tolerably large fragments of the spleen and other parts in order to detect the presence of hog-cholera bacilli, so few may these be. The colonies of the hog-cholera bacillus are generally distinguishable from those of the swine-plague bacillus by their

larger size and coarser, more opaque, grayish-white growth; but sometimes, especially in roll and plate cultures crowded with colonies, these differences are so little marked and each of these varieties of colony is in itself so little characteristic that it is particularly important to secure the aid of inoculation of animals with parts of organs to differentiate these organisms and to recognise the presence of one or both. If both swine-plague bacilli and hog-cholera bacilli are present in the part examined, rabbits and mice inoculated with this part will die of swine plague, and if reliance were placed solely upon the animal experiment the hog-cholera bacillus, if present, would be overlooked.

The statement is made in publications of the Bureau of Animal Industry, that if the hog-cholera bacillus is present, it will be found invariably in the spleen.* In the cases in which we have demonstrated the presence of the hog-cholera bacillus we have very rarely failed to find it in the spleen. Still we have notes of a few cases in which both the inoculation of animals and of culture media with good sized bits of the spleen has yielded negative results, and the hog-cholera bacillus has been found in other parts, so that we must dissent from this statement. We have found the hog-cholera bacillus in the intestine when it has been absent from the spleen.

When a mixture of pathogenic organisms has been present we have been helped out occasionally, especially in examining the intestine, by making roll or plate cultures from the neighbourhood of the seat of inoculation in rabbits. By this means we have detected both the swine-plague bacillus and the hog-cholera bacillus together in the intestine, when otherwise we should have failed to find the latter organism.

One of us (Welch) had described in an article published in 1892† the principal characters of the hog-cholera bacillus and of the swine-plague bacillus, and it is not necessary to repeat

* Theobald Smith: "Special Report on the Cause and Prevention of Swine Plague," pp. 44, 103, Washington, 1891, and other places. It should be said, however, that Dr. Smith admits the possibility of the localisation of the hog-cholera bacillus in the intestine, when it is absent from internal organs, but he has not published observations demonstrating this fact. He says, op. cit., p. 103: "The difficulty of examining the intestines for pathogenic bacteria and the amount of labour involved is very great, and hence for want of time and sufficient assistance this part of the work has been set aside in these investigations, and the attention centred on the lungs and other internal organs." Notwithstanding this admission, we do not think that he always recognises sufficiently in his publications the possibility that some of the cases with intestinal lesions which he regards as pure swine plague may have been combined swine plague and hog cholera, with localisation of the hog-cholera bacilli in the intestine, nor does he appear to know that rarely hog-cholera bacilli may not be found in the spleen, even when demonstrable in other internal organs.

† William H. Welch: "Preliminary Report of Investigations Concerning the Causation of Hog Cholera," *The Johns Hopkins Hospital Bulletin*, December, 1889.

here this description, which was essentially confirmatory of the results obtained in the Bureau of Animal Industry.

We wish, however, in this connection, to express our conviction that the organism described by Selander in 1890, and probably also that by Metchnikoff later, as the hog-cholera (or swine-pest) bacillus is not identical with the genuine hog-cholera bacillus as we know it in this country. This point needs special emphasis, as the Metchnikoff hog-cholera bacillus seems to have been accepted without question as the genuine hog-cholera bacillus, and the already existing great confusion as regards this organism is likely to become almost inextricable unless this error be corrected.

Our present criticism refers only to the organism described by Selander in 1890. in the *Annales de l'Institut Pasteur*, and not to that described by him as the bacterium of swine pest in the *Centralblatt für Bakteriologie* in 1888. By experiments conducted in Pasteur's laboratory under Roux, Selander, starting with a culture of the swine-pest bacillus of 1888, which killed rabbits in three to seven days, claimed by a special procedure to enhance the virulence of this bacillus to a point at which it killed pigeons, which are not very susceptible to the hog-cholera bacillus, in ten to twelve hours, and rabbits in twelve to fifteen hours by subcutaneous injection of small doses, and in five hours by intra-venous injection. The procedure consisted essentially in inoculating in series rabbits with the crushed spleens in bouillon of rabbits dead of inoculation with the bacillus, the spleen of one rabbit being used to inoculate the next, and so on. He found that the fourth rabbit in this series died in fourteen hours. The virulence was still further enhanced by inoculating pigeons in series.

Selander's statements were so much at variance with our experience that we have repeated his experiments exactly according to his directions. We have carried the series to over twenty rabbits without obtaining any noticeable diminution in the duration of life of the inoculated rabbits. At the end, as well as at the beginning, of the series the rabbits died in four to six days after inoculation.

The hog-cholera bacillus is most tenacious of its special characters. Original variations in virulence, and to some extent in other properties, occur, but with one and the same bacillus we have not succeeded by successive inoculations of animals in producing very marked changes in the degree of virulence; nor have we ever met a kind of hog-cholera bacillus which, by subcutaneous inoculation of ordinary doses,

regularly killed rabbits in less than three days, although occasionally rabbits may die in less than that time.

Dr. Selander, through the friendly mediation of Prof. Salomonsen, of Copenhagen, kindly supplied one of us (Welch) in August, 1890, with a sealed tube* of the blood of a pigeon dead of inoculation with his bacillus, and also with an hermetically sealed agar culture of the same bacillus of exalted virulence. We beg to express our thanks to both Dr. Selander and Prof. Salomonsen. These tubes were received in Berlin, and were brought to this country by one of us in the same package with cultures of Schweine-seuche, swine pest, swine fever, and other bacteria. They were opened and examined early in October.

Selander's tubes contained a short, oval bacillus, resembling the bacteria of the hæmorrhagic septicæmia group. The organisms in both tubes were dead, neither cultures therefrom nor inoculation of rabbits or mice yielding positive results. The cultures of various other organisms conveyed in the same package from Berlin were all alive. The media in Selander's tubes were not at all dried down. Unless some unknown injurious agency acted upon these cultures of Selander's bacillus before they were handed to us by Professor Salomonsen, the fact that the cultures were dead excludes, we believe, the presence in them of the hog-cholera bacillus, which survives at least two years in agar culture protected from desiccation. Selander, however, believes that his bacillus with exalted virulence has become less resistant than the hog-cholera bacillus of ordinary virulence; but in view of our experience in repeating Selander's experiments to heighten virulence, we believe that the bacillus which he obtained after serial inoculations of rabbits and pigeons was not derived from the hog-cholera (swine-pest) bacillus, but was some different species of micro-organism.

We should suspect that possibly in the course of his experiments there developed a case of rabbit septicæmia, and that the subsequent culture was done with a culture from such a source, were it not for his statement that the subcutaneous, intro-venous, or alimentary inoculation of swine with his bacillus with heightened virulence produced diphtheritic enteritis, a lesion which is not known to be caused in swine

* One of these tubes was dated either April 28, 1890, or July 28, 1890; we could not positively make out which. Assuming that it was the earlier date, the culture, when examined, would have been less than six months old. The other tube was undated. As the dates of Selander's experiments in Pasteur's Institute, as given in his article, run from March to June, 1890, the cultures could hardly have been at the utmost more than seven or eight months old, and were probably, as appears from the date mentioned above, less than that age.

by the bacillus of rabbit septicæmia. Microscopically, the bacteria in Selander's cultures given us were decidedly smaller than the hog-cholera bacillus. Many bacilli of the hæmorrhagic septicæmia group die in a few days or weeks in artificial culture. In fact, we have had some difficulty in obtaining from Europe living cultures of the Schweine-seuche bacillus which belongs to this group. Whatever this organism of Selander may have been, we feel convinced that it was not our hog-cholera bacillus, and we base this conclusion upon the results of his experiments in Pasteur's Institute, as published, and upon our experience with the cultures with which he kindly supplied us.

We are unable, moreover, to reconcile with the properties of the genuine hog-cholera bacillus the description given by Metchnikoff of the so-called microbe of hog cholera with which he performed his experiments on immunity, described in the *Annales de l'Institut Pasteur*, May, 1892. He says that he has obtained the same results as those of Selander. He describes his hog-cholera microbe as most pronouncedly pleomorphic, growing in short rods, long threads, and veritable cocci, sometimes as a streptococcus, and killing rabbits in a few hours. He gives it the name cocco-bacillus suinum. This name and this description are singularly inappropriate for the genuine hog-cholera bacillus, which is no more pleomorphic than the typhoid bacillus. Unlike the swine-plague bacillus, it does not grow in forms suggesting cocci. Metchnikoff states that the blood-serum of the rabbit is not germicidal for his hog-cholera microbe. In our experience the normal rabbit's serum is germicidal for the hog-cholera bacillus to about the same extent that it is for the typhoid bacillus. We believe Metchnikoff's hog-cholera microbe to be one of the hæmorrhagic septicæmia bacilli, possibly the swine-plague or Schweine-seuche bacillus.

(*To be continued.*)

EXPERIMENTAL PRODUCTION OF BOVINE CONTAGIOUS PLEURO-PNEUMONIA BY MEANS OF CULTURES. DEMONSTRATION OF THE SPECIFICITY OF THE *PNEUMO-BACILLUS LIQUEFACIENS BOVIS.**

BY PROFESSOR ARLOING, DIRECTOR OF THE LYONS VETERINARY SCHOOL.

I. In two notes which were inserted in the *Comptes Rendus de l'Academie des Sciences* of September 9th and 16th, 1889, I

* Communication made to the French Academy of Sciences on July 6th.

gave a *résumé* of my investigations in the bacteriology of bovine contagious pleuro-pneumonia. In the second note I more particularly dealt with my attempts to determine the microbe that is the cause of the disease. "The determination of a pathogenic microbe is complete," I wrote on September 16th, 1889, when by inoculation of its cultures we have reproduced the lesions from which it proceeds." I then showed that it had been impossible for me to reproduce exactly and with all their intensity, the characteristic lesions of the natural disease, or those which sometimes accompany inoculation of the virulent serum from the lung into the connective subcutaneous or dermic connective tissue, with pure cultures of the microbe which I have named *Pneumo-bacillus liquefaciens bovis*. Nevertheless, in presence of a series of facts of secondary value, but all concordant and obtained during a course of numerous attempts at inoculation, I concluded as to the specificity of the pneumo-bacillus.

Since that time I have not ceased to seek for the definitive proof of my assertion as to the integral reproduction of the disorders caused by the pleuro-pneumonic virus in the lungs and connective tissue by means of cultures of the above-mentioned microbe.

The doubts raised by competent people as to the etiological value of the pneumo-bacillus of contagious pleuro-pneumonia impelled me to furnish this demonstration; for these serious doubts were based on the hypothesis that the disease was probably due to a living particle that could not be cultivated or stained by the means now employed in the study of known microbes.

During my investigation I perceived that the pneumo-bacillus formed in its culture broth toxic substances to which animals bearing pleuro-pneumonia lesions are more sensitive than healthy ones. I was also able to assure myself that the completed cultures which were in a certain state virulent, conferred on the ox an immunity equal to that given by the serum from a diseased lung inoculated according to the procedure of Willens and Hasselt, and without any attendant risk. But I will return to this point again.

In the meantime I desire to show: 1, that the essential agent of the virus comports itself like ordinary microbes; 2, that this agent is the pneumo-bacillus.

II. It being admitted that the pleuro-pneumonic virulence is the function of a living particle, it ought to increase with the number of particles present in the serum of the diseased lung.

If this particle is an ordinary microbe, and if its vehicle might be suitable for its cultivation, in placing the serum carefully obtained under conditions in which this microbe might multiply, the activity of the latter should increase up to a certain point, in proportion to the duration of the cultivation. Consequently, if equal quantities of pure pulmonary serum are submitted to incubation in a stove at 35° Cent., then inoculated beneath the skin of an ox, and local effects are produced which increase with the duration of the incubation, it might be concluded that the pleuro-pneumonic virulence is the function of an ordinary microbe. And experiments have yielded results in accordance with these previsions. The pulmonary serum augments in virulence and becomes slightly turbid while in the stove, the turbidity being due to an increase in the number of the germs, as is shown by the cultivation in gelatine when this is possible.

It might be inferred from these experiments that the pathogenic agents of pleuro-pneumonia are living particles which can be multiplied in their natural medium, like other microbes with which we are acquainted.

III. Cultivations in gelatine of the serum from an incubatory stove have shown simultaneously an increase in virulence and in the number of germs. If I add that the most numerous colonies of these germs are liquefying, it must be logical to infer that the *Pneumo-bacillus liquefaciens* is the pathogenic agent of pleuro-pneumonia.

But this kind of demonstration should be also an indirect solution of the second question mentioned in this note, on which I will not insist, for I am in a position to give a peremptory reply to it.

I was convinced, on the one hand, that the effects of my inoculations tending to demonstrate the etiological *rôle* of the pneumo-bacillus would prove insufficient, because the activity of the microbe propagated in my cultures was originally too feeble, and, on the other hand, I had remarked, even before 1889, that the organisms contained in the pulmonary serum became more virulent in their evolution beneath the skin of the ox. Therefore it was permissible for me to hope that I would find more active microbes, such as I desired, in the coccygeal lesions supervening Willemsian inoculation—lesions which are gradually invading in spite of surrounding unfavourable conditions. I was therefore most anxious to undertake a series of cultures and inoculations with the germs obtained from these lesions, and M. Robin, sanitary veterinary surgeon in Paris, has afforded me the opportunity for doing so.

In the deep layer of the dermis and in the intermuscular connective tissue of a tail which had become swollen under the influence of pleuro-pneumonia virus, I have discovered many more microbes than in the midst of the pulmonary lesions. These microbes multiplied rapidly and abundantly in highly peptonised beef bouillon. Adopting Koch's method of separating species of microbes, I was able to isolate two kinds of bacilli which differed chiefly in their power of promptly liquefying gelatine. The non-liquefying bacillus is generally shorter than the other, though both are abundantly provided with cilia. The liquefying bacillus exactly corresponded in all its characters to that which I had previously designated *Pneumo-bacillus liquefaciens bovis*. By propagating it in a state of purity, I have been able to make experiments in order to ascertain its physiological action.

B. Firstly, I was struck with the intensity of the subcutaneous effects of two cubic centimetres of a second generation culture. There was rapidly formed a tumour having all the external and internal characters of one produced by the most active pulmonary serum. But after having considerably extended in a few days, these subcutaneous accidents tend to become circumscribed in the same manner often observed after inoculation with the pulmonary virus.

C. In view of such remarkable local effects, I thought the occasion was an excellent one for undertaking successful intra-pulmonary inoculations.

a. I prepared a culture of the third generation, and next day introduced two cubic centimetres of it deeply into the right lung of a fifteen-months old steer; this inoculation was repeated on the second day thereafter. Immediate disturbance became manifest in the form of more or less intense dyspnœa, tympanism, acute injection of the superficial capillaries and moderate hyperthermia. The mean central temperature was about 39·5° Cent.

Three days later the animal was killed, and at the autopsy I found in the posterior lobe of the right lung a pneumonic mass larger than a fist in size, and offering in the highest degree all the characters resulting from natural contagion—that is, considerable thickening of the interlobular septa, hepatisation of the lobules complicated at certain points with more or less extensive intralobular hæmorrhages, which gave it the appearance of infarcts. There were slight pleuritic lesions around this pneumonic mass and on the corresponding parietal and diaphragmatic pleuræ. Besides the alterations, I found pleurisy in the right sac, around the pericardium and

on the surface of the anterior lobe of the corresponding lung. At this part the alteration had reached the interlobular spaces, and even the lobular tissue. The mediastinal lymphatic glands were tumefied, congested and pulpy. There were no changes in the lung and pleura of the opposite side.

b.—With a second animal a little larger than the preceding, I injected into the right lung two cubic centimetres of a culture of the fourth generation, which was more advanced than the preceding, as the microbes had commenced to be deposited at the bottom tube. An hour afterwards the creature was lying down and suffering from virulent dyspnœa. It died in less than three hours, the nostrils being filled with foamy mucus. At the autopsy there was observed a little serum in the pleural cavities, no trace of inoculation, but œdematous infiltration of the two lungs which prevented retraction of the posterior lobes and added considerably to the weight of the organs; there was also violent general congestion, which gave to certain lobules a hæmorrhagic character.

This animal had been somewhat exceptionally susceptible, and having received a rather strong dose of a culture rich in soluble principles, rapidly succumbed to the immediate effects of the substances contained in the pneumo-bacillin.

D.—In a third experiment, I inoculated into the posterior lobe of the right lung of a young bovine, a fourth generation culture of the pneumo-bacillus liquefaciens; the culture dated from the previous evening, and the dose was a half-cubic centimetre. This inoculation was repeated on three succeeding days with successive cultures. I resorted to this *modus faciendi* in order to avert the immediate toxic effects of the inoculations when the doses were larger. After each inoculation the animal manifested an immediate and somewhat acute reaction; its temperature rose above 40°Cent., and then remained about 39·7°.

Six days after the first inoculation the animal was sacrificed. The autopsy showed pneumonic nuclei as large as an apple lying against each other, and very characteristic, There was disseminated pleurisy in the form of patches on the external face of the base of the right lung; the inflammation had even traversed the diaphragm and established itself between that septum and part of the anterior surface of the liver. The pleurisy assumed a greater intensity on the surface of the pericardium, anterior mediastinum, and at some points on the anterior lobule of the lung. Flakes yellowish, elastic, false membrane were suspended at these regions.

d.—Lastly, in a fourth experiment, in order more surely to avoid the immediate toxic effcets, I merely injected the microbes contained in ten cubic centimetres of a tenth generation culture. The separation was effected by means of a sterilised amianth filter, the microbes being suspended in sterilised water. The cannula of the syringe was directed a little too far backward, so that the bacilli were deposited beyond the base of the lung, on the two faces of the diaphragm. Notwithstanding the subtraction of the culture bouillon, there still remained in the atmosphere of the bacilli sufficient toxic substance to cause immediate disturbance, which, though only temporary, was troublesome enough. The temperature was maintained about 40°Cent., and at one time it rose to 40·9°; the respiration was accelerated, and expiration jerking and plaintive.

At the autopsy, which was made five days later, I found a sero-fibrinous infiltration of the diaphragm, which had been propagated to the lung in front, and to the peritoneum and liver behind, and in such a manner that these three bodies were formed into one in a tumefaction surrounded by false membranes. The subpleural and interlobular spaces at the base of the lung were thickened, as well as the conjunctival portion of the hepatic gland in the contiguous region, the glandular portion itself having assumed a yellowish tint at some points. I also noticed very marked pleurisy of the pericardium and the two anterior lobes of the right lung; false membranes covered the free extremity of these lobes, and fixed them to the pericardium, while here and there were cavities full of a citron-coloured fluid. There was likewise a certain quantity of somewhat turbid serum, and very notable tumefaction of the mediastinal and subpleural lymphatic glands.

E. In fine, I have succeeded in reproducing in the ox, with pure cultures of the *Pneumo-bacillus liquefaciens bovis*, comprising those between the second and tenth generations, beneath the skin and in the chest, the typical alterations caused by the virus of contagious pleuro-pneumonia. I have even obtained the principal kinds of thoracic lesions observed in practice—pneumonia, pleuro-pneumonia with predominance of pleural alterations, and lesions of the base of the lung propagated to the diaphragm, the peritoneum and the liver.

I may, therefore, peremptorily affirm that the *Pneumo-bacillus liquefaciens bovis* is the pathogenic agent of bovine contagious pleuro-pneumonia.

Having, however, greater chances of finding the pneumo-bacillus endowed with stronger virulence, I shall continue to study several questions with regard to pleuro-pneumonia, or to take up others with more certainty of success, and more especially that of preventive inoculation, as well as that of the age of the lesions when a focus of latent or effective contagion is discovered accidentally or tardily.

SUMMARY OF FURTHER REPORT ON SURRA.

BY ALFRED LINGARD, BACHELOR OF MEDICINE AND MASTER OF SURGERY (DURHAM); DIPLOMATE IN PUBLIC HEALTH (CAMBRIDGE); FELLOW OF THE BOMBAY UNIVERSITY; PROFESSOR OF BACTERIOLOGY AND COMPARATIVE PATHOLOGY, CIVIL VETERINARY DEPARTMENT, INDIA.

I.

HORSE SURRA.

A.—*Recent Outbreaks of Surra in fresh Localities.*

KATGODAM, N.W. Provinces (elevation 1,900 feet). Before 1890, many tonga ponies (principally Cábulis) succumbed to Surra. Forty also died in 1890, and fifteen between 1891 and 1893. The disease occurs during the rains, first at the Katgodam stables, and later at the stables of the first stage (Bhugia ghàt, elevation 2,500 feet), but never above the latter. At first the supposed cause was contaminated water; but although *pure* water has been supplied since the early part of 1892, the outbreaks continue yearly. Careful observations in February, 1894, revealed the presence of rat excrement in some quantity in the grain stored for future use.

2. In 1893, an outbreak occurred in the stables of the Dâk ponies running between Sáháránpore and Mussoorie. (Rayment.)

3. In the same year a horse arrived in the Port of Bombay from the Persian Gulf, suffering from Surra. (Mills.)

4. In Burmah (1893), the Kachins lost 14 elephants from the disease, out of a total of 32, used for timber drawing. (G. H. Evans.)

5. Other outbreaks have occurred, one in Sind, among the horses of the Preventive Force (Police Report), and others, details of which have not been received.

B.—*Treatment of Horse Surra.*

Since the publication of the last report, the experimental treatment has been continued with success, the hitherto fatal

disease having now proved amenable to certain drugs. The following is an outline of the case.

2. The animal contracted Surra by gastric ingestion of soiled blood, after a latent period of six days. Treatment was commenced at once, consisting of arsenic as liq. arsenicalis, in gr. iv. doses, increasing rapidly to 12 grs. daily. After a paroxysm of five days, during which time the næmatozoon was very numerous, it disappeared from the blood. The arsenical treatment was continued for 65 days, 454 grs. of arsenic being administered. At this period the animal showed an aversion to the arsenic in this form. For this reason, and as previous experience pointed to the fact that arsenic by itself did not, in *some* cases, destroy the resting or immature form of the hæmatozoon, the double iodide of arsenic and mercury was substituted, as it was known that the iodide of mercury does not form an albuminate, and consequently the whole of the salt would be available. The iodides were continued for a period of 106 days, in order to ensure the absolute destruction of the immature form. In all, 1822·75 c.c., of 288 grains each of the tri-iodide of arsenic and biniodide of mercury were given. Since the medicine was discontinued about eight weeks have elapsed, and the animal is in good health and condition, and no hæmatozoon has appeared in the circulation for 423 days, or over seven months. For six and a half months during this period the animal has averaged 4½ miles walking exercise daily. As it did not thrive on grain, barley (boiled) was given in its place, with the most satisfactory results, the animal rapidly putting on flesh.

3. An experiment was made with the alkaloid of adhatoda vasica, "Vasicine," which was observed microscopically to have a certain effect upon the Surra hæmatozoon. Twenty-two grains of the freshly-prepared alkaloid in distilled water were injected directly into the blood stream of a horse during the presence (numerous) of the hæmatozoon in the circulation. But although numerous examinations of the blood were made for some hours after the injection, the organism was apparently not affected.

4. Observations have been made to determine the efficacy of subjecting healthy animals to drugs, sufficient to cause the full physiological effects, previous to submitting them to experimental inoculation with surra:

(i.) By subcutaneous inoculation with soiled blood,

(ii.) By communicating the disease in a somewhat similar

manner to that in which it is naturally contracted, viz., by small repeated doses of the hæmatozoon in water.

The chemicals made use of during these experiments were:

(*a*) Arsenic.

(*b*) Tri-iodide of arsenic and biniodide of mercury.

In the first instance, although the latent period was not lengthened, the course of the disease was undoubtedly modified, only a few hæmatozoa being at any time in the blood; and although the disease had run for some weeks, the animals still maintain a fair condition. Owing to the reasons given below, the drugs administered were insufficient to withstand the severe and unnatural test of subcutaneous inoculation. As a lengthened period is required to communicate Surra by the second method, the experiments are not yet concluded, but the results, as yet obtained, warrant one in believing that they will be successful. It appears that animals suffering from Surra have a greater tolerance of arsenic than healthy animals, when the drug is administered for a lengthened period, as in the above experiments. Difficulty was experienced in getting the horses, accustomed to be watered at a river or tank, to take the drug (in water), or even pure water from a bucket. No such difficulty occurred in treating previously-recorded Surra cases received from Bombay, where horses had always been used to the latter method. During an acute attack of a disease only lasting a few days, it is easy to administer drugs by drenching; but in the treatment of Surra, when it is necessary to administer medicines two or three times daily for a period of some weeks, drenching is out of the question, as any unnecessary disturbance of the animal, and possible injury to the mouth, is prejudicial, and would certainly retard recovery

5. Several interesting physiological problems have been worked out relating to the ingestion and excretion of nitrogen during health, and the course of the disease (Surra) under treatment. The results of these will be published when the cases are complete.

II.

Rat Surra.

A.—*Historical Account.*

*Lewis in 1887 detected organisms in the blood of the rat.

* Lewis, T.—Flagellated organisms in the blood of healthy rats. Appendix 14th Annual Report of San. Com. with Gov. of India, 1878.

Two species of rat harboured these parasites, *Mus decumanus* and *Mus rufescens*. But although Lewis examined the blood of a large number of mice, he never detected organisms, nor did he see them in any animals other than rats. He found the organism present in rats examined in Calcutta, also at Simla, elevation 7,500 ft. The animals kept by him in cages, for weeks remained to all appearance in perfect health.

2. Wittich* and Koch† in 1881 described similar organisms in the blood of hamsters in Germany.

3. ‡ Crookshank in 1886 found that 25 per cent. of rats taken from the London sewers contained these active organisms.

4. § Vandyke Carter's observations on rats included *Mus decumanus* and *Mus rattus*. Twelve per cent. of the rats examined presented the organism in their blood. A few examples examined of *Mus bandicottus* (?) and of Sorex *species* (also of mice), gave negative results. Vandyke Carter's inoculation experiments included the subcutaneous injection into healthy animals of tainted blood of the rat, the animals so employed being rats, dogs, cats, horses (6), and monkeys. On microscopical examination of the last-named animal's blood, taken from a digit 18 and 24 hours after inoculation, two hæmatozoa and one hæmatozoon were respectively observed. It did not however seem quite certain that a reproduction of the rat's organism had taken place in the circulation of the monkey; but possibly this was so to a very limited extent. These inoculation experiments therefore all proved negative in their results, except in the doubtful case of the monkey.

B.—*Experimental investigations re Hæmatozoon in Rats and Bandicoots at the I. B. Laboratory.*

From November, 1890, to May, 1892, the blood of 349 rats was examined microscopically, and the hæmatozoon was found present in 106, and absent in 243, giving a percentage of 30·37 present to 69·63 absent. Again, from June, 1892, to July, 1894, the blood of 758 rats has similarly been examined, but with the elucidation of more details, and with the following results:

* Wittich.—Spirillen im Blut von Hamstern. Centralblt. f. Med. Wiss., 1881, No. 4.
† Koch.—Mitteilungen aus der Kaiserlich Gesundh, 1881.
‡ Crookshank, E. M.—Flagellated Protozoa, &c.; Journal Royal Micros. Soc., Nov. 1886.
§ Carter H. V.—Scientific Memoirs by Medical Officers of the Army of India, Vol. VI., 1887, p 59.

TABLE I.

Showing the Rats (M. d.) examined from June, 1892 to July, 1894, and the relative number of organisms in their circulation.

	Absent.	Few.	Numerous.	Very numerous.	Swarming.	Total Rats examined.	Present.	Absent.
In field of microscope ...	...	1—5	5—20	20—50	over 50	...	...	...
Number of Rats ...	443	107	66	66	76	758	315	443
Percentage ...	58·44	14·12	8·71	8·71	10·02	100·00	41·56	58·44

TABLE II.

Showing total number of Rats (M. d.) examined during the years 1890—1894, with number of hæmatozoa present and absent.

	Present.	Absent.	Total.	Percentage present.	Percentage absent.
Number of Rats	106	243	349	30·37	69·63
	315	443	758	41·56	58·44
Grand Total ...	421	686	1,107	...	...
Percentage	38·03	61·97	100·00	...	...

2. Dividing the (Bombay) year into two periods,

(i) Dry and hot (January to May inclusive),

(ii) Rainy and humid (June to December inclusive),

we find that during the period, November to June, 1894, 421, out of a total of 1,107 rats examined, contained the hæmatozoon in their circulation. It was present in 31·53 per cent. of the rats caught from January to May, and 40·31 per cent. of those obtained from June to December, or during the rainy season. Although in the hot season the hæmatozoon is present in the circulation of these animals, the organisms are very few in number, while during the latter period of the year they are far more numerous, the percentage of cases in which the hæmatozoa are very numerous or swarming, being 24·00 in the dry season and 52·61 in the rainy reason, or in a ratio of 1 : 2·19.

3. There is a tendency in the hæmatozoon to disappear from the circulation of some rats, when kept in captivity and supplied with clean food and water.

4. About 60 per cent. of young rats from 2 to 4 months old have the hæmatozoon present in their circulation, and usually in large numbers.

5. The blood of rats obtained from certain localities was almost free from the hæmatozoon, while that of the majority of rats from other localities was affected.

6. The hæmatozoon of the rat appears to disappear from the circulation at irregular intervals, thus producing paroxysms and intermissions, as in the case of Surra in the Horse.

7. The presence, in varying numbers, of the hæmatozoon in the circulation of rats, does not appear to produce any noticeable symptoms in the great majority of them. But some few rats, whose blood swarmed with the hæmatozoon, have succumbed to leucocytosis, with extravasations of blood, containing the organism, into the anterior chamber and vitreous humours of the eye, opacity of the cornea, enlarged spleens, and extravasations of blood, or in some cases ulceration of the mucous membrane of the stomach.

8. It has been observed in a considerable number of cases that although the hæmatozoon may be present in vast numbers in the blood of pregnant rats (*M. d.*), in no case has the hæmatozoon been discovered in the circulation of the fœtus.

9. *Parasites, Stomach.*—Nematode worms, varying in number and dimensions, were found in the stomach of rats in which the hæmatozoon was either present or absent. In a total of 203 examined, nematodes were found in 40 or 19·75 per cent.

10. *Saliva.*—Microscopical examination of saliva proved the absence of the Trypanosoma, when the hæmatozoon was swarming in the blood at the same time. Immediately, however, a slight wound of the mucous membrane of the mouth was made, the organisms were discovered in varying numbers according to the amount of blood mixed with the saliva.

11. *Urine.*—The hæmatozoon was always absent from the urine of rats, although swarming in the circulation at the time of examination.

12. *Bandicoots* [*Mus* (*Nesokia*) *giganteus*].—Previous observers have denied the presence of the hæmatozoon in the bandicoot; but as early as 1892, I demonstrated the presence of the organism in the blood of young and half-grown animals

of this species, whether caught in Bombay and its surroundings, or on the Deccan plateau; but it has been absent from all full-grown animals examined.

13. *Musk rat* (Sorex cœrulescens) and *Mice* (Mus. species).—The hæmatozoon has not been found in the blood of these animals.

C.—*Experiments on Animals with the Hæmatozoon of the Rat.*

Proof was wanting that this hæmatozoon was capable of producing Surra, when blood containing the organism was subcutaneously injected into horses, and some other species of animals. As early as November, 1890, I commenced a series of experiments for the purpose of deciding the above question, and obtained positive results, but found that the periods of incubation were more prolonged than in Horse-Surra, in one case being as much as 63 days. Notwithstanding this, the virulence of the disease when once developed was intense, as shown by the short period during which the animal survived, after the appearance of the hæmatozoon in the blood; this being in three cases only 2 to 5 days.

(*a*).—*Inoculation with the soiled blood of the Rat* (*Mus. d.*).

Of twelve horses inoculated with soiled rat's blood, four animals contracted Surra, or 33·3 per cent.

(i) Period of Incubation lasted 18 days. Animal lived 19 days.
(ii) „ „ „ „ 29 „ „ 2 „
(iii) „ „ „ „ 13 „ „ 2 „
(iv) „ „ „ „ 63 „ „ 5 „

Although the latent period of rat Surra was so prolonged in the first instance, when inoculated from rat to horse (average 40·7 days), it immediately returned to the normal period (average 7 to 8 days), when a second horse was inoculated with the blood of the first affected. The latent period however becomes still more reduced (5 days), when a third animal is inoculated with the blood of the second.

2. Horses unsuccessfully inoculated, and re-inoculated subcutaneously with the rat hæmatozoon, when subsequently inoculated with horse Surra blood, show no protection from the former, but acquire the disease after an incubation period of six to ten days.

3. Animals other than horses, which contracted the disease, were: Bovines, monkeys and field rats; while the rabbit, guinea-pig, fowl, cat, dog, and donkey proved refractory to

the rat hæmatozoon. But all the above animals, with the exception of the fowl, were very susceptible to the rat hæmatozoon, when it had first been passed through the horse.

(*b*).—*Experiments on the gastric ingestion of Rats' excrement.*

The above experiments raised the question as to how rats could cause the disease in horses; for the food would rarely, if ever, be soiled with the blood of these animals. It therefore only remained to be tried, whether the excreta of rats, in whose blood the infusorian was present at the time of its collection, could cause the disease when mixed with grain.

2. In 1892, experiments were undertaken at Poona, on the Deccan plateau, where the disease is not enzootic, and where the difficulty of producing it was fully recognised, owing to the dryness of the situation at that period of the year (December to February). These experiments as expected proved negative.

3. At a later date, during the latter half of the hot season and the rains of 1893, further experiments with the same end in view were carried out in Bombay, where the climate is favourable from its humidity, and the disease is enzootic. From these, positive results were obtained, the incubation period occupying four months (about June to September); but the incubation period of the disease will probably be found to vary with the amount of moisture present in the atmosphere and amount of *materies morbi* ingested by the animal. This points to the probability of a number of the Surra cases in Bombay being contracted through the injection of rats' or bandicoots' excreta mixed with the corn. Although not yet definitely proved, it is more than likely that the excreta of young and half-grown bandicoots have the same power of producing the disease, as the hæmatozoon is also frequently present in their circulation.

III.

Bovines.

A. Bull, No. I. inoculated successfully with Surra in 1892, and whose case was included in Vol. I. of the Report, was re-inoculated subcutaneously with Surra, one year and a half after the first inoculation. The animal proved refractory to the disease, and apparently was still protected against another attack.

B.—*Transmission of the hæmatozoon from the Mother to the offspring through milk.*

A cow, with a calf three weeks old at her side, contracted Surra. The blood of the mother was found to contain the hæmatozoon for a period of 120 hours.

The calf was allowed to suckle three times in the 24 hours, and the milk from each teat was daily examined microscopically for the presence of the organism; but this was never discovered. However, on the 38th day from the appearance of the hæmatozoon in the circulation of the mother, it appeared in the blood of the calf, which up to that date had been free. The organism remained in the circulation for 24 hours only, and had not re-appeared 123 days later.

2. We have no direct evidence as to whether human beings are susceptible to the virus of Surra; but there is no doubt that they do not readily contract the disease. During the performance of one hundred autopsies on horses which have succumbed to the disease, I have contracted wounds which were at once treated antiseptically; and the mahars have had severe cuts and jags from their blood-stained instruments; but no infection followed.

3. In Burmah –the only country reported up to the present where Surra is seen in cattle (G. H. Evans), and where one might expect to find cases of this disease in human beings following the use of cows' milk,—the inhabitants as true Buddhists are not permitted to use it as food.

(*To be continued.*)

ON MASKED AND LATENT GLANDERS.*

BY DR. V. BABES, PROFESSOR OF EXPERIMENTAL PATHOLOGY AND BACTERIOLOGY AT THE MEDICAL FACULTY OF BUCHAREST.

GLANDERS is justly regarded as a very dangerous disease, attacking as it does not only the equine family, but frequently men also, especially in certain countries like Russia and Roumania.

The prognosis of this affection is always unfavourable, whether it be of the acute or chronic variety.

Since the contagious and infective character of the disease was recognised, stringent regulations have been enacted in all countries with the view of restricting, as far as possible, its ravages. Horses suffering from glanders are killed by

* Read at the International Congress of Hygiene and Demography, held at Budapest in September last.

the authorities, an indemnity being paid to their owners, and animals with which they have been in contact are isolated and kept under strict observation, while at the same time contaminated stables are more or less thoroughly disinfected.

Nevertheless, in spite of these various measures, glanders has not materially decreased in frequency, and it is still often difficult to account for the infection of a particular stable.

The same remark holds good in respect of human glanders, for cases are not rare in which there is no evidence whatever of contamination or infection. Out of eleven persons who died from glanders in the city of Bucharest, five only had been in contact with animals affected with the disease, whereas the horses with which the other six had been more or less concerned were absolutely free from any glanderous disorder.

A very interesting case was that of a man occupied as groom in a stable where there was a horse suffering from glanders, and who became ill with pleurisy, but recovered. After that he became oxherd in a region where there were no horses at all. Six years later this man, who in the meantime had never been near a horse, died of glanders.

The conditions under which contagion takes place are so frequently inexplicable, that this isolated case probably would not have attracted my attention, had I not since then met with a series of cases calculated to throw light on the ætiology and pathology of glanders.

I.

Early in 1890, Mr. Aurel Babès, Director of the Chemical Department of the Bacteriological Institute at Bucharest, at my suggestion extracted by dialysis from cultures of the bacillus mallei a toxic substance regarded as an albumose. On July 12th, 1890, we authorised Dr. Hankin to announce this result to the Royal Society of London.* In 1891, employing Koch's procedure for the preparation of tuberculin, we succeeded in extracting from cultures of the glanders bacillus a substance analogous to the other, but still more toxic, and possessing thermogenic properties, as I have been able to show. This substance, employed in the same manner as tuberculin, determines a characteristic rise of temperature in animals suffering from glanders, while in healthy animals,

* Kalning, who is regarded in France and Germany as having been the first to make use of the chemical substances elaborated by the bacillus of glanders, imitated in his researches the method used for the preparation of tuberculin, and the results he obtained were not published until 1891, so that we are obviously entitled to the priority in this question.

or those presenting other affections, this effect is much less marked. Tuberculous animals are not entirely unaffected by injections of this toxin, to which, in view of its resemblance to tuberculin, we have given the name mallein.* The chemical substance obtained the year before from cultures of the glanders bacillus, which possesses the same qualities as mallein, A. Babès named *morvin*.

In the course of the same year, 1891, Helmann, without being aware of our researches in this direction, and, later, Preusse and other bacteriologists, arrived, independently of each other, at the same result as ourselves. These authors, as well as Nocard in France, and Semmer in Russia, have demonstrated that a very small quantity of mallein reacts on horses affected with glanders, and this substance, therefore, is of considerable diagnostic value in suspected and apyretic cases.†

Continuing our researches, we then announced ‡ the results of certain experiments which proved not only that mallein is a valuable means of detecting glanders, but that very small repeated doses of this substance frequently cure glanders in horses in a few months, the morbid symptoms completely subsiding, after which even strong doses of mallein no longer produce a rise in the temperature. I have also found that, like the horse and the guinea-pig, a man affected with chronic glanders is acted upon by mallein; only, in man a dose five or six times smaller (from 2 to 4 centigrammes of mallein, or from 2 to 4 milligrammes of morvin) suffices to produce the same reaction as the larger dose in a horse. Persons suffering from other diseases than glanders are not affected by much stronger doses, so that mallein may be employed in man also as a means of diagnosing the disease.

In the course of a series of numerous and varied experiments carried out the past winter under the direction of the Minister of the Interior of Roumania, by a Commission composed of Messrs. Locusteanu, Persu, Furtuna, Fometescu and A. Babès, and of which I acted as Chairman, we demonstrated anew the great value of mallein for diagnostic purposes. In a stable where there were horses suffering from glanders, twelve horses suspected of being glandered

* N. Kalindero and V. Babès. Zwei Fälle von mehrere Wochen lang andauernder Allgemeinreaction bei Leprösen nach einmaliger Einspritzung von 0.8 mg. Tuberkulin, nebst Bemerkungen über die Wirkungen des Tuberkulins. (*Deutsche med. Wochensch.*, April 2nd, 1891.)

† Exploratory injections, to which we shall refer later on, have been made at the same time with our mallein and Nocard's.

‡ V. Babès. Observations sur la morve. (*Arch. de méd. expérim. et d'anat. pathol.*, Sept., 1891.

and twelve others, apparently healthy, reacted on administration of this substance, and were all *post-mortem* found to be affected with the disorder, while about thirty healthy horses furnished no indication of the characteristic reaction.

This reaction, determined by the injection of 20 centigrammes of our mallein or 2 centigrammes of morvin, consists in a sudden rise in temperature of at least 2 degrees, manifested within from four to ten hours after the injection. This hyperthermia is usually accompanied by a local reaction, and frequently by loss of appetite and rigors; it lasts for from ten to fourteen hours, seldom longer. On the following day the temperature falls, but it may remain above normal, only to rise again on the next day, though the rise is less marked than before.

II.

On making a careful analysis of our results, the Commission was greatly struck by certain special features. We noted, for instance, this important fact that, among apparently healthy horses occupying infected stables, or localities in which animals suffering from glanders had been housed some months previously, from 30 to 90 per cent. exhibited the characteristic reaction of glanders. Out of these, twelve, which were isolated and kept under observation, remained in good health for several months; six others were killed, and the autopsy revealed the existence of various glanderous lesions, some presenting tracheal changes concurrently with fresh caseous nodules in the lungs and other viscera.*

In the great majority of these animals, however, the internal organs were perfectly healthy. There were only found some slight cicatrices on the pituitary membrane, as well as disseminated subpleural nodules the size of a lentil or pea, surrounded by a dense capsule of a dark colour, the centre of which was occupied by a caseous or mortar-like matter.

In a certain proportion of cases, the most careful histological examination failed to reveal the least trace of any irritation due to the presence of these nodules, which had no connection with either the bronchial tubes or vessels. The capsules, composed of sclerous tissue with few cells, were surrounded by fibrous tissue which was also poor in cells and alveoli, and presented no special appearances worth mentioning. The central substance of the nodules consisted of a

* Quite recently, in a series of experiments carried out in France on apparently healthy horses, it was found that 30 per cent. of these animals reacted, a fact which suggests that probably cases of latent glanders will be discovered there also.

pale, necrotic connective tissue, containing fragments of nuclei, as well as granulo-adipose elements without distinctive cellular character, embedded in a granulo-adipose matrix along with calcareous concretions and a mass of hyaline granulations. Attempts to cultivate, and inoculation experiments with this substance, gave negative results.

In two instances the capsule, though dense, was thin, and the central portion of the nodule, distinctly caseous, had even broken down in the middle. Around these nodules were seen here and there accumulations of wandering cells. Although in these two cases the bacillus of glanders was not discovered under the microscope, cultures gave a positive result, while inoculation of the nodular substance in a guinea-pig was unsuccessful. Nevertheless, from the first culture—which developed very slowly and of which the colours were not strongly characteristic—a second culture was obtained, the inoculation of which determined typical glanders in a guinea-pig, from which the animal died.

In other instances the small peripheral nodules in the lungs presented the following characteristics under the microscope: it was even more obvious than by the naked eye examination that they consisted of clearly defined, encapsuled corpuscles, the seat of which suggested, at any rate in some cases, modified subpleural follicles. The capsule consisted of several fibrous layers, between which were seen swollen fixed cells and, in addition, some wandering cells, as well as some larger cells, which were basophile, plasmatic, or filled with pigmented granulations. The peripheral portion of the nodule was formed of a granular mass, usually containing remains of cells; then came a thin layer of embryonic cells with segmented nuclei and containing pigment. In the central portion of the nodule was a faintly stained substance, comprising a large number of nuclei, whole or in fragments, and other larger elements, provided with prolongations, frequently containing dark-coloured granulations, of which the protoplasm stained uniformly red. Here and there small embryonic centres existed in the midst of this degenerated tissue. The nodules were surrounded by infiltration of embryonic tissue, while the neighbouring alveoli enclosed a pale, granular substance. In certain bronchioles the same substance was found, mixed with embryonic elements presenting fragments of nuclei. Neither in the nodules, nor in their neighbourhood, was the bacillus of glanders discovered.

Near these nodules there are found, in some cases of latent

glanders, small peripheral infarcts, distinguished not only by a congested condition of the alveolar walls, but by the presence of brown amorphous masses of pigment in certain arteries, the lumen of which is dilated and obstructed by yellow granulations, resulting from the breaking down of the red blood-corpuscles, as well as by a granular substance mixed with leucocytes. The bronchi of these regions present very marked epithelial proliferation, and are filled with mucus and leucocytes. The alveoli are compressed and contain a pale granular substance with vacuoles, broken-up nuclei, and especially round vacuolar masses, which are also of a pale colour, derived from the cells by a special form of degeneration, and resembling those met with in the glanderous nodules. Microscopical examination, however, has nowhere revealed the presence of the bacillus of glanders, although its existence in these foci has been demonstrated by the results of culture and inoculation on animals.

Thus, in the organism of healthy horses in which an exploratory injection give rise to a reaction, a whole series of anatomo-pathological changes have been observed, constituting an affection with a marked tendency to spontaneous recovery, these changes being of all degrees of severity, from fresh lesions of the mucous membranes to sclerous and sterile nodules of the internal organs, which are the latest in date.

III.

Our investigations show, for instance, that, in a stable where there are 20 horses, only 1 or 2 may be manifestly affected with glanders, the other 18 or 19 horses being apparently in good health. Yet, though there is no perceptible sign of the disease at the time of examination, the majority must be regarded as glandered.

Inasmuch as in most of the larger cities in Roumania, and especially at Bucharest, glanders exists as an enzoötic disease, so to speak, we are led to conclude that one-third or one-half of all horses may be looked upon as infected. The Commission, in fact, found that a large proportion of the horses belonging to private persons at Bucharest, though healthy in appearance, reacted to morvin and must, therefore, be regarded as possessing glanderous nodules.

Considering that this nodular form of glanders has not as yet been described in countries where the glanderous infection has, however, been thoroughly studied—Germany and France, for instance—and seeing that, moreover, in those countries glanders is regarded as incurable, one is fain to admit that

this disease frequently assumes a special type in our part of the world.

Dr. Semmer (St. Petersburg), who has observed facts similar to those I have set forth, assumes that in Russia there exists a malignant and a benignant form of glanders, and that the nodules in question are indicative of the latter, adding that he has never found living bacilli in these nodules.

For my own part, I do not see my way to accept his views without reservation, for the reason that it has been demonstrated by our Commission that in certain cases these nodules contain bacilli—attenuated it is true—but capable of becoming virulent under the influence of successive cultures. There is every reason to think that this variety of glanders, extremely common in Roumania, is, I repeat, entirely unknown in Germany and France, and that, therefore, it is peculiar to warmer countries and probably to a hardier race of horses. This would, consequently, be a sort of *localised latent* type of glanders, determined by the same microbe to which the true, undoubted form of the disease is due, in the same manner as scrofulosis frequently represents a localised latent form of tuberculosis. It has indeed been noticed that horses from Southern countries, when removed to the North, frequently become glandered, a fact which tends to prove that these animals were already affected with *latent* glanders, which only needed favourable conditions to break out.

In former researches I have shown how frequently the bacteria of suppuration are associated with the bacillus of acute glanders, and this combination of bacteria may therefore be regarded as one of the causes of the recrudescence of latent glanders.

Latent glanders very often begins with inflammatory lesions of the nasal mucosa, as pointed out by the frequent occurrence of cicatrices in this region in horses attacked by this variety of the glanderous affection. At this latent or masked stage of the disease, it must necessarily be the more contagious, seeing that no precautions are taken to prevent infection from horses which are quite healthy in appearance, in spite of a few glanderous nodules having developed in the lungs, liver, spleen, etc. After months, and even years have elapsed, these lesions gradually heal, the ulcers cicatrise and the abscesses change into sclerous nodules, in which living, though attenuated, bacilli are found for a long time to come. These micro-organisms are finally destroyed, and the horse may be regarded as cured; but the toxic substances secreted

by the pathogenic agent of glanders still persist for a longer or shorter space of time in the organism of the animal, and it is doubtless these substances which, effervescing under the influence of the mallein, produce the characteristic febrile reaction in cases in which no living bacilli are found to be present.

It may happen, however, that these substances are gradually modified and eliminated, so that the horse no longer exhibits any reaction from the toxin, a fact which I have seen very strikingly illustrated.

In the stables of the Bucharest fire brigade, where two glandered horses had formerly been housed, ten of the healthy horses were malleinised, with the result that eight presented the typical reaction, and were killed in consequence. In four of the latter, nodules were found in varying proportions in the lungs, liver and spleen; in two instances these nodules contained living bacilli. The two horses in which no reaction was perceived presented nodules of the same kind, but they were sterile, calcified, and easily enucleated, in the form of small and very hard globular masses.

There is no room for doubt that, as long as these nodules contain living bacilli, the disease is always liable to break out in animals thus affected, as we have found on several occasions; seeing that, in some cases of acute glanders, in addition to abscesses and nodules of recent date, a quantity of ancient nodules were met with, presenting the characteristic lesions of latent glanders.

These facts are of the utmost importance from a prophylactic point of view, as regards glanders in horses as well as in man. It is now easy to understand why sanitary police regulations hitherto have had so little effect in preventing the spread of the disease. Considering that, in a stable where all the horses were found to be suffering from glanders, not a single one presented the least morbid symptom, it can readily be conceived that, before we possessed a diagnostic measure as sensitive as the injection of mallein or morvin, there was no possibility of preventing glanders from breaking out in this or that animal. On the other hand, it is obvious that if the characteristic reaction is produced in some of the horses examined, excellent results may be obtained by their isolation.

It must, however, be extremely difficult to remove the danger of contagion from animals affected with glanders, for this would necessitate isolating nearly half the horses. Under such circumstances, we are of opinion that the best means of

preventing the disease from spreading is to malleinise and keep under observation for some time those horses which, though healthy in appearance, present evidence of reaction, taking care to repeat the injection from time to time in order to render the animal resistant, and hasten its recovery from glanders.*

IV.

The unsuspected frequency of masked and latent glanders in horses, and the fact that spontaneous recovery takes place in a large number of cases of the disease– the possibility of which has been denied by most investigators, but must, nevertheless, be looked upon as the rule, for otherwise half the horses would die from glanders in certain countries– suggest the question whether the glanderous infection in other animal species, and more particularly in man, does not present the same peculiarities as those I have just described.

It is known that cultures attenuated by age do not kill the animals experimented upon, but determine a disease which may run on for a long time without becoming fatal. However, if the attenuated bacillus taken from an animal in these conditions be inoculated upon a very sensitive subject, like the cat for instance, it may recover its original virulence, as well as by artificial culture on certain nutritive substances.

Are we to conclude that the same holds good in infection of the human organism by attenuated bacilli? Does a masked or latent type of glanders exist in man also?

I have had occasion to observe several cases of death from various diseases of coachmen or grooms, who at the necropsy presented nodules identical with those found in latent glanders of the equine species, when cured, or in a fair way of recovery. These nodules were formed by hard sclerotic tissue, calcified at the centre. Sometimes the lungs were studded with these nodules, and at the same time there existed pleural adhesions of old standing.

I was under the impression that I had to do in these cases with ancient tubercular or syphilitic lesions; but the nodules were never localised at the base of the lungs, nor surrounded with cicatricithal tissue, and there was no trace perceptible in their vicinity of either tuberculosis or syphilis.

In 1891, I found at the autopsy of a groom who had died

* The following is an illustration in point: We malleinised 50 horses of one regiment. Among these, 24 reacted and were separated from the other horses, the malleinisation being renewed from time to time. At the end of two months, ten of these horses no longer reacted, and a fortnight later there were only ten left which presented the characteristic reaction.

from chronic nephritis, a considerable number of these nodules containing broken down caseous masses. On attempting cultivation of this caseous substance, I was amazed to notice the appearance on potatoes of luxuriant brown patches, resembling cultures of glanders, and formed by bacilli in every way comparable to the *bacillus mallei*. Inoculation of the first culture determined localised chronic ulceration.

I have also described an analogous microbe found in the waters of the Dimbovitza, and which I regard as an attenuated variety of the glanders bacillus.

If we now return to the case to which I alluded at the beginning of this article, it will be found that it furnishes a strong argument in favour of my contention. The oxherd in question had for several months been suffering from a chronic form of glanders accompanied by fistulous muscular abscesses, which sometimes cicatrised and then opened anew, ultimately causing the death of the patient. At the necropsy, in addition to these subcutaneous and muscular abscesses, I found subpleural purulent collections surrounded by hæmorrhagic infarcts of the lungs; but at the same time there existed in both lungs calcified nodules encased in a capsule, more or less thick, black, and of very ancient date, at the level of which there were very old pleural adhesions. In this case, bacteriological examination disclosed the existence of combinations of the glanders bacillus with a round microbe, forming large, flat, white colonies on agar-agar, and presenting under the microscope the aspect of small, very thin chains.

Another case, particularly interesting on account of the existing combinations of microbes, was that of a soldier, who for a long time had had nothing to do with horses, but who presented on the anterior aspect of the leg deep cicatrices resulting from ulcerations of indeterminate nature. A traumatism caused the reappearance of this ulceration, with fever, gangrene, and abscess in the cellular tissue of the leg. On microscopical examination the staphylococcus aureus was found, associated with the bacillus mallei.

V.

These observations in man, added to what has been observed in horses, prove the frequency of the existence of a type of glanders much more frequently met with, indeed, than the form hitherto described. In this form the disease may

remain *masked* from the onset, giving rise to a few morbid manifestations, then it becomes *latent,* and it usually subsides on the production of nodules of a peculiar structure in various organs, notably in the lungs, mediastinal and bronchial glands, spleen, and liver; these nodules tend to become encapsuled and undergo calcareous changes. It is probable that this form of the glanderous infection is determined by attenuated bacilli, and that it supervenes principally in individuals presenting a special power of resistance to the action of the bacillus mallei, and living in countries the mean temperature of which is tolerably high.

This latent benign form, however, may become acute and fatal, if the affected subjects are placed in unfavourable conditions of resistance, either by their removal to colder regions, or by the association of pyogenic or septic microbes with the bacillus of glanders.

The most interesting point, as far as human medicine is concerned, is that the nodules which I have described may be met with in persons who have been in more or less close and prolonged contact with horses, and that in such cases, the presence of living, though attenuated, bacilli of glanders may be demonstrated. These facts are all the more important, inasmuch as they furnish the clue to the appearance of glanders in persons who for a long time have not been near an infected horse. Seeing that it is admitted that, in the absence of external lesions, it is impossible to diagnose glanders in man, there is every reason to assume that many cases of internal glanders with benign and but slightly marked symptoms are passed by without being noticed; no thought, in fact, being given to glanders until signs of this disease become unmistakably manifest, while in the majority of such cases there may be accidentally discovered, after death due to an intercurrent affection, *capsulated nodules* which are but *unrecognised lesions of masked glanders.*

Editorial.

MASKED AND LATENT GLANDERS.

In the interesting and valuable paper under the above heading, read by Dr. V. Babès, of Bucharest, at the recent International Congress and Demography held at Budapest, and which we publish elsewhere, the author insists that the masked or latent form of glanders he describes is entirely unknown in Germany and France, and therefore, it might be inferred, in this country; and he bases his assertion on the circumstance that it is not described in writings dealing with the malady. He also arrives at the conclusion that this nodular pulmonary form must be special to warmer countries, and probably to a hardier race of horses. We can scarcely believe that Dr. Babès has carefully examined the literature of the subject, for had he done so he would have found that occult glanders has been recognised, not only in France and Germany, but also in this country. We have drawn special attention to it in the section of "Veterinary Sanitary Science and Police" dealing with glanders and farcy (Vol. I, pp. 506, 521), and have alluded to it as *internal* or *masked glanders*. We have also said that the expert, "when called in to decide upon an outbreak of glanders and the cause for its maintenance, cannot be too careful in his examinations of even the unsuspected animals. Many outbreaks persist for months, and even years, owing to horses affected with this occult form being allowed, through lack of knowledge, to remain alive and associate with others. Regiments of cavalry, batteries of artillery, and omnibus, cab, and other establishments have been so haunted and ravaged for sometimes long periods, and the records of such events are numerous." This statement was founded on our personal experience before the publication of the book nearly twenty years ago, and subsequent experience has added largely to the instances then recorded. The pathological anatomy of this pulmonary form of glanders is also described in the work alluded to. So that, so far from this form of the disease being special to any country or breed of horses, we believe it to be observable everywhere, and notably in the United Kingdom. The introduction of mallein as a diagnostic aid has, of course, greatly facilitated its detection, and shown it to be much more common than was at one time supposed.

Dr. Babès' statement as to the curative value of mallein is

most worthy of attention, and should be put to the proof without delay. There is nothing at all improbable or unlikely in the therapeutic action of this substance, and if it will cure glanders then it must be hailed as a grand discovery that will remove a slur from the reputation of veterinary medicine, which has been accused of having only one recourse in dealing with this and some other contagious maladies, viz., the free use of the pole-axe for diseased and suspected animals. It is high time such an imputation were removed by the introduction of scientific methods of combating such plagues.

MILK CONTROL IN COPENHAGEN AND STOCKHOLM.

UNDER the above sub-heading the *Lancet* quite recently published an interesting article from one of its special correspondents in Scandinavia which merits attention by those of our readers interested in public hygiene. Dealing with the question of milk supply and the dangers attending the use of that fluid when contaminated with the virus of disease, the writer alludes to what is being done in Copenhagen and Stockholm in the matter of providing pure and safe milk; for, unfortunately it cannot be denied that boiling it does not improve its flavour, and consequently the step is more often honoured in the breach than in the observance. Since outbreaks of scarlet fever, diphtheria, and enteric fever have in numerous instances been traced to infection, something has been done by legislation in this country to safeguard it from contamination, notably by the Dairies, Cowsheds, and Milkshops Order of 1885, with its section prohibiting a person suffering from any dangerous infectious disease, or who has been recently in contact with a person so suffering, to participate in the production, distribution, or storage of milk. But still there is every reason to doubt whether in country districts, beyond the mere fact of being registered, the cowkeeper is much affected by the Order or at all realises its importance.

An additional source of danger, it is remarked, must be attributed to milk, since it has been agreed that human and bovine tuberculosis are the same disease, and few educated would not now be prepared to admit the extreme probability of tubercle being caused in the human subject by the consumption of cows' milk containing tubercle bacilli. Certainly numerous experiments have absolutely proved that calves may be infected when fed on such milk, and the large number af cases of tubes mesenteria occurring in children is not without considerable significance in this respect. One is therefore justified in saying that the milk from cows with tubercle of the udder is positively dangerous, and the supply of such milk should be regarded as little short of criminal. Fortunately, however, this condition is not very commonly met with, as it is usually secondary to tuberculous deposits elsewhere, and only appears late in the disease. Professor Bang, of Copenhagen, who has made the subject of bovine tuberculosis peculiarly his own, states that the udder was affected in only one per cent. of the cattle slaughtered in the abattoir there. The question then is, how far can the milk of tuberculous cows be regarded as safe when the above serious condition is not found? Professor Bang maintains that it must be considered suspicious, although in the great majority of cases it is doubtless consumed with impunity. This opinion he bases on his own experiments, and those of many other investigators, which were made by introducing milk from such animals into the peritoneal cavity of others prone to tubercle. Thus, of forty guinea-pigs inoculated with the

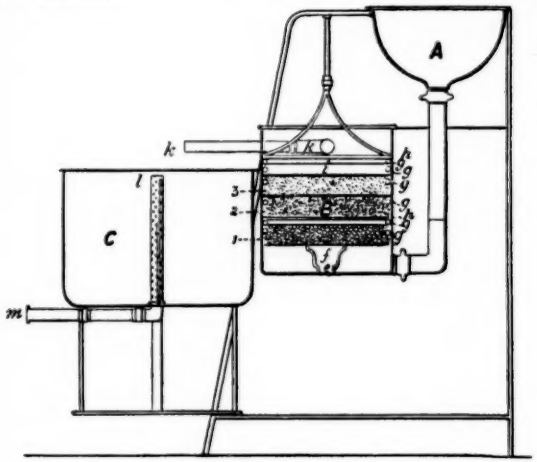
milk from twenty-one tuberculous cows four became affected. Experiments in regard to this seem to show that it is a question of degree—the more tuberculous the cattle the more virulent its properties for infection, and *vice versâ*. It becomes therefore a matter of serious importance to try to exclude as far as possible the milk from animals affected with tubercle, and this is what is aimed at, amongst other things, both in Copenhagen and Stockholm. In both cases the problem of a pure milk supply resolves itself into a question of minute attention to detail; but the details are so important and carefully worked out that they deserve to be widely known. It should at the outset be stated that the description which follows does not by any means apply to the whole of the milk-supply in the two towns, but only to that of two large companies, the one in Copenhagen, the other in Stockholm. As there are certain marked differences in the methods adopted in each case it may be well to deal with them separately.

Copenhagen.

The guarantees that the Copenhagen Milk-supply Association give of the purity of their milk are: (1) veterinary control of all the cows on the farms and exclusion of all the milk from suspected animals; (2) cooling of the milk by ice to 41° F. or lower at the farms and at the company's depôt; (3) filtration of the whole of the milk through fine gravel; and (4) absolute cleanliness of all the bottles and cans used, and the fact that they are delivered under the security of the company's seal.

Veterinary control at the farms.—The company has in its service seven veterinary surgeons, one of whom devotes the whole of his time to the work of visiting the farms in rotation. Permission was kindly given me to accompany him and see the *modus operandi*. One of the conditions is that all cows in summer must be fed in the open fields on grass and clover. Stall feeding, except in winter, is strictly prohibited. In Denmark the custom is universal to tether the cattle out at short distances from one another, so that every inch of ground is covered, and the farmer can estimate almost exactly how much grass has been eaten. It can be readily understood that where 200 cattle are together it would be well nigh impossible to examine them all minutely on one day; consequently, the veterinary surgeon examines each cow at every visit only as regards the condition of the udder, auscultating one-half of the animals at his first visit and the other half at the second. Each farm is visited twice a month. The point noted as to the udder are its consistency, whether there are any signs of inflammation or induration about it, and whether nodules exist in its substance. The glands in its neighbourhood are also felt. Attention is then directed to the skin, which should in a healthy animal be soft and freely movable. The glands, especially those in the axilla and inguinal region, are carefully felt, as they often give valuable information as to the existence of tubercle. The submaxillary glands, the superficial glands of the neck, and those at the angle of the jaw are examined, but their enlargement is an accompaniment of so many morbid processes that not so much reliance can be placed on their condition as a means of detecting tubercle. Last year among the 5,000 or 6,000 cows supplying milk to the company 122 were found to be tuberculous, but only in two of these was the udder affected. If the veterinary surgeon detects a tuberculous cow it must at once be separated from the others and got rid of as soon as possible. Or, again, if the health of a cow is so bad that the milk may be prejudically affected thereby, he may order the withdrawal of the milk for a certain time. The farmer is bound to report any case of illness occurring between the veterinary surgeon's visits, and to withhold the milk until he arrives. Infectious disease occurring amongst the employés must at once be reported to the company and the milk kept back. Other conditions which are set down in the agreement between

the farmer and the company have reference to the storage of milk and the feeding of the animals. The greatest cleanliness must be observed in the milking, and, as has been stated, the milk must at once be cooled to 41° F. by ice, having been first strained through a sieve covered by a clean woollen cloth. As to the food in winter, this consists chiefly of rape-seed oil-cake, hay and straw, and brewers' grain; anything likely to give the milk an unpleasant taste, such as turnips, &c., is absolutely forbidden. It might very naturally be asked, How have the farmers been brought to acquiesce in these strict conditions, entailing both extra trouble and expense, imposed on them by the company? The answer is simply that it has been done by an appeal to their pockets, the company agreeing to pay them a better price than they could get from any other buyer. Even the milk that is withheld owing to the temporary sickness of an animal or employé is paid for at the full price just as though it were used.



FILTERING APPARATUS.

A, Receiving tank. *B*, Filter. *C*, Storage or mixing tank. *e*, Indiarubber ring to preserve enamel against— *f*, Iron foot-piece or base. 1, 2, 3, Perforated metal trays to hold the gravel, of which No. 1 is the coarsest. *g*, *g*, *g*, Indiarubber rings to protect enamel. *h*, *h*, *h*, Galvanised rings. *i*, Five ply of filter-cloth of close texture, surmounted by one ply of very fine texture. *k*, *k*, Pipes which lead off milk, as it rises in filter tank, into storage tank. *l*, Perforated tube so constructed as to draw milk from every part of the tank and so equalise the quality. *m*, Pipe leading through partition to bottling room.

Treatment of the milk at the depôt.—The company's premises are close to the railway, so that very little time is lost in transit. When the whole of the milk for the day has arrived, the milk from every can is tasted, and a sample from every farmer is taken for analysis. The milk is then filtered, the arrangements for which are, I think, unique. A reference to the diagram, which I am permitted to reproduce here by the kindness of the publishers of an article entitled "Milk Supply in Copenhagen," by A. Stewart MacGregor, British Vice-Consul, will enable the principle to be readily grasped. The filtering material is fine gravel, placed in perforated tin trays. The gravel in

the lowest tray is about the size of a split pea, and in the highest that of a pin's head. The milk is poured in at A, and passes by a process of upward filtration into the receiver, C. The amount and nature of the filth that is kept back by the gravel have to be seen to be believed, and this, too, notwithstanding the precautions taken in milking. The perforated tube that is seen in the receiver, C, and is to be found also in the cans, allows of the milk being drawn from all depths, so that as nearly as possible a uniform quality is maintained from first to last. From the tube *m* the cans and litre bottles are filled. They are then placed in trays containing ice until required for distribution. About 3,000 litre bottles are filled every evening, and the milk in them is guaranteed to keep fresh for twenty-four hours. Every can and bottle is most scrupulously cleaned before being used. For cleansing the cans a little soda is introduced, and a strong jet of steam is made to play upon the interior. Nor is the size of the cans so great that the bottom cannot be easily reached by the hand and well scrubbed. The bottles are cleansed by a soda solution and the insertion of a brush turned by machinery, being washed out afterwards by sterilised water. When empty, all bottles and cans are placed on racks, bottom upwards, so that air can not only circulate round them, but under them as well.

In order not to complicate the description, reference has only been made to milk, but the company, as might be expected, does a large business in cream also, which is treated in just the same way, even to the filtering. The cream, however, is never got by the use of a "separator, as it is rightly contended that ordinary skimmed milk, containing as it does about one per cent. of fat and all the albuminoids and lactose, is still a most valuable food. Nor has reference been made to a great feature of the company's work—namely, the production of what is called "children's milk." Only the milk from the best and healthiest cows is used for this, and special regulations exist as to their food in winter. A great impetus, too, has recently been given to the preparation of "Pasteurised milk." Bottles of the milk to be sterilised are placed in frames in a trough of water. A coil of steam pipes heats this to a temperature of 75° C., when a contact thermometer rings a bell, which gives the signal for shutting off the steam. When the water has cooled down to 60° C., the bottles of milk are taken out and placed in ice. It is guaranteed to keep for forty-eight hours. For the sake of infants that must be bottle-fed, sterilised milk, variously diluted, is prepared. A Chamberland filter supplies the water, and the bottles, with the degrees of dilution labelled on them, are sold in cruets containing just such a number as is sufficient for one day. The feeding nipple fits on to the neck of the bottle, so that there is no length of indiarubber tubing to become foul.

Analyses of the milk are made, not only at the company's depôt, but also under the direction of Professor Bohr, who publishes monthly the results of the daily analyses. All the milk that remains unsold is used for making butter. The sale takes place in general directly from the company's carts in the streets. The price paid for the milk is as follows:—Children's milk, 1s. per gallon; sweet milk 10d. per gallon; half-skimmed milk, 5d. per gallon; No. 1 cream, 5s. per gallon; No. 2 cream 3s. per gallon. What has been described sounds, perhaps, rather utopian, but nevertheless the company is on a firm financial basis, and pays its dividend of five per cent. on the capital invested. More than this it is not allowed to pay, as when the company was started in 1878, express provision was made that anything over and above the five per cent. interest should be devoted to lowering the price of the milk and to improving the general arrangements. Its origin and success are almost entirely due to Mr. Busck, founder of the Scandinavian Preserved Butter Company, who has brought the various points in general management and mechanical contrivance to the highest perfection. It is interesting to know

that he would not undertake the task without first receiving an assurance of support on the part of the medical profession generally.

Stockholm.

The company in Stockholm undertakes the sale of two kinds of milk—namely, controlled and uncontrolled. The conditions under which the former is produced, although its amount is much smaller than the latter, have naturally the greater interest. What is meant by "controlled milk" is that coming from the company's own cows under the most careful supervision possible. On their large estate, some thirty miles from the city, the company has built two large cowsheds. The one of these at Hjortsberga has 150, and the other at Mölnbo 180 cows in it. The walls, floor, and feeding troughs are cemented; they are well lighted, and have special arrangements for ventilation. The great difference between the Copenhagen and Stockholm arrangements is that in the latter—and almost invariably in Sweden—the cows are kept in sheds both in summer and in winter, only occasionally getting out for exercise, whereas in the former they must be out in the fields throughout the summer. A staff of men is constantly engaged in cleaning the animals and removing the refuse. There is no smell in the buildings, as everything is quickly absorbed by the dried peat which partially fills the channel into which the excreta pass. Before milking is begun the floor is swept perfectly clean, and the milkmaids must wash their hands, wear special aprons, and clean the udders carefully. All the cans are washed with boiling water, and the milk is strained through muslin and very fine copper-wire gauze before being removed to the cooling room, where it is kept in ice till it is required to be sent away. The most important point in the sanitary control is the fact that the company employs a qualified veterinary surgeon, who lives on the estate and regularly examines the animals, paying especial attention to the detection of tubercle. In addition, the city veterinary surgeon periodically visits and inspects the animals. Any animal found to be affected with tubercle must be got rid of. Nor does the company, further, keep any cows more than a few years. After they have calved two or three times they are sold, so that only those at their best milking periods are in the stalls. The milk from cows that have newly calved must be withheld seven days. Great stress is laid on the importance of keeping the standard of "children's milk" as high as possible, all the finest and healthiest cows being set aside to furnish it. The daily average in 1892 of the analysis was:—

	Sp. gr.	Fat.	Total solids.
Children's milk ..	1032 ..	4·01% ..	13·14%
Ordinary milk ..	1032 ..	3·83% ..	12·91%

The charge for the controlled milk is 18 öre per litre (about 2d.), and for uncontrolled 15 öre, a difference which, considering the infinitely superior guarantee as to purity given by the former, is not great. On the estate there is a small hospital for isolating any case of infectious disease that may occur amongst the employés on the farm.

Tuberculin as means of diagnosing Bovine Tubercle.

Professor Bang's researches into bovine tubercle, have led him to believe that its spread is very much dependent on the size of the herds. On small farms, where there are only a few cattle, it is very often quite absent, becoming more frequently found the larger the herds. He believes that the bacillus finds an entrance into the system with the food, the retro-pharyngeal glands and those of the alimentary canal becoming first affected. Calves born of tuberculous parents, if isolated from them and fed entirely on boiled milk, will remain free from tubercle. He has carried out experiments on a large estate where most of the animals were tuberculous, to begin with, but by this

isolation of the calves he has improved the stock in a remarkable manner. The method he adopts for diagnosing tubercle in cattle is the injection *sub cutem* of 0·4 gramme of tuberculin in full-grown animals and of 0·1 gramme in calves. A reaction follows as in man, and in at least 90 per cent. he believes the reaction points to tubercle. So important does the Danish Government consider these experiments to be, as opening up the possibility of eliminating tuberculosis from cattle, that it has given Professor Bang nearly £3,000 a year for five years for their continuance. The farmers can have their cattle tested, they can have the services of a veterinary surgeon gratuitously, provided only they will agree to adapt their sheds so that the healthy animals and newly-born calves can be isolated from those that are suspected.

THE BUBONIC PLAGUE IN SOUTH CHINA.

An epidemic, in some respects resembling the Black Death of the Middle Ages, has been causing much alarm and mortality in South-East China, and especially at Canton and Hong Kong. It is known as the "bubonic plague," and also as the "Yunnan plague," from its being endemic in that western province of China. It is described as an acute specific of an intensely fatal character, accompanied by high temperature, cerebral congestion and delirium, and the formation of painful swellings of the lymphatic glands. The virulence of the poison of the disease is exerted not only on mankind, but also on animals, which it attacks in the following sequence, according to Chinese observation—rats, poultry, goats, sheep, cows, and buffaloes. The height of the animals from the ground affects the order of the seizure of the particular group of creatures, and man, being the tallest in point of distance of the head from the earth, is the last to be attacked. Mr. Cantlie, however, in the *British Medical Journal* for August 25th, is inclined to dispute the correctness of this statement, though he says that there is one fact about rats and rat infection which must be considered. Where the plague has been in China—whether Yunnan, Pukhoi, Canton, or Hong Kong, the mortality among rats is excessive. Dead rats were found in abundance, and in an hotel in Hong Kong, as many as forty were counted in one day. "The rats seem to leave their haunts in sewers and drains, and, escaping by their holes, seek the houses. They appear to be careless of the presence of man, and run about in a dazed way with a peculiar 'spasm' of their hind legs. They are frequently found dead on the bedroom floor, but more often the foul odours from their dead bodies under the flooring is a proof of what is going on. This may be all ascribed to native popular belief, and even the statements of many Englishmen who have seen the circumstances above recorded may be slighted; but when it is known that in the blood and in the viscera of all the rats found during the plague, the bacteria of plague were present, the tale assumes a scientific interest. Not only so, but buboes are found likewise, and the peculiar gait of of the animal, ascribed to spasm, is nothing more or less than the limping consequent upon a painful bubo. Further, the dazed appearance of the animal is exactly in harmony with the symptoms met with in man.

"Nor does the matter end here. Inoculation of healthy mice, rats, guinea-pigs, etc., with the blood from a gland affected by plague, or from a tube cultivation, causes a fatal malady in the animal, characterised by buboes in the groin and a wealth of bacilli in the blood and viscera.

"The rat infection, therefore, cannot be passed lightly by, but must enter seriously into the conditions affecting the spread of the disease. Even assuming that rats are affected, and we cannot doubt it, they may be merely affected in common with man, or they may be the actual carriers of the disease to human beings. A miasm the toxic influence may still, however, be, and the nearest we can get to the means of spread and infection, is that the disease is miasmatic-contagious."

THE PRODUCTS OF THE GLANDERS BACILLUS.

In *Il Moderno Zoöiatro* for last April, Bonomi gives the results of his observations on the action of mallein on man and the horse. From these it would appear that the biological products of the glanders bacillus vary according to the culture, medium, and the degree of virulence of the cultures themselves, while with regard to the animals which are susceptible to the action of these products, they are not alike in their susceptibility.

Thirty-two suspected horses received, by inoculation, quantities of mallein varying from 1 to 1·5 cubic centimetre. Of this number 24 gave the usual reaction; of these, 18 were slaughtered, and only one of them did not exhibit glander lesions. The other six which were not killed, were decided to be glandered after their secretions, when inoculated into dogs and guinea-pigs, had given the disease to these creatures.

Bonomi concludes, as the result of his observations, that the febrile reaction induced by the injection of mallein, is not an infallible indication of the existence of the disease, and that if it may be affirmed that all glandered horses react to the mallein, it cannot be asserted that all horses which give this react are diseased.

Bonomi had the opportunity of experimenting, for the first time, with mallein on a man suffering from glanders, and was able to observe its therapeutic action. Small doses, such as 1-15th to 1-20th cubic centimetre, produced a febrile reaction in seven hours after their injection, with increased frequency of the pulse, pulyuria, heaviness of the head, and tumefaction of the affected membranes; this reaction lasted for thirty hours. During the two succeeding days the temperature ranged between 35·5° and 36°Cent. Repeated injections of the same doses brought about a great amelioration in the condition of the patient, but there is no mention of recovery.

With a glandered horse he appears to have arrived at more definite results, by employing mallein prepared from the blood and tissues of a glandered cat. In forty-five days he gave fourteen injections with this material, and this treatment was followed by the disappearance of all the symptoms of glanders. That the horse really had the disease was proved by the inoculation of four guinea-pigs, which were infected by having been inoculated with its nasal discharge. A year after the treatment the horse was in perfect health. Dogs which had been made glandered by experimental inoculation, were also cured in the same way, while control animals which had not been malleinised, succumbed. It should be mentioned, however, that he was unsuccessful in curing guinea-pigs which had become glandered by inoculation.

In conclusion, he states that the glanders bacillus yields products which, according to the conditions in which they are formed and the kind of animals into which they are injected, are really efficacious as a means of diagnosis, and also sometimes as a means of cure.

RICKETS IN ANIMALS.

Dr. Chamier, of Tours, France, is making investigations into the nature of rickets, and would feel greatly obliged to any of our readers who may be in possession of observations on (1) the pathological anatomy of that condition in animals, and (2) its epizootic and contagious nature, if they would place themselves in communication with him. His address is 19 *bis*, Rue de Clocheville, Tours, France.

Obituary.

Mr. J. Blunsom, M.R.C.V.S., Cirencester, died on September 1st, aged 61 years. He graduated in 1853.

Mr. F. J. Insall, M.R.C.V.S., of Coleshill, Warwickshire, died on September 4th. He graduated in 1877.

The deaths are also reported of W. L. Fenner, M.R.C.V.S., of Clare, Suffolk, who graduated in 1855, and served in the Army for a short time during the Crimean War; and of W. B. Forbes, M.R.C.V.S., of Reigate, Surrey, who graduated in 1859.

Army Veterinary Department.

Gazette, August 28th.

THE following Veterinary-Lieutenants to be Veterinary-Captains:—T. Marriott, F.R.C.V.S., H. T. Pease, G. H. Evans, E. R. C. Butler, F.R.C.V.S.

VOLUNTEER CORPS: SIXTH LANCASHIRE ARTILLERY.—J. K. Pilkington, gent., to be Veterinary-Lieutenant.

Gazette, September 9th.

FIRST DEVON, WESTERN DIVISION, ROYAL ARTILLERY.—Veterinary-Lieutenant J. Heath resigns his commission, also is permitted to retain his rank and to continue to wear the uniform of his corps on his retirement.

FIRST NORTH RIDING OF YORKSHIRE, WESTERN DIVISION, ROYAL ARTILLERY.—R. Elliott, gent., to be Veterinary-Surgeon.

Gazette, September 19th.

YEOMANRY CAVALRY, AYRSHIRE.—J. Dickie, gent., to be Veterinary-Lieutenant.

Veterinary-Lieutenant C. B. Freeman, W. A. McDougal, and F. S. H. Baldrey embarked on 31st August for a tour of service in India.

Veterinary-Captain W. A. Crow has been brought on the Home Establishment, and posted to Chatham for duty.

Veterinary-Lieutenant J. H. Jackson has been brought on the Home Establishment, and posted to 10th Hussars at Ballincollig for duty.

Veterinary-Captain W. B. Spooner has been transferred from Ipswich to Sheffield.

Veterinary-Lieutenant-Colonel G. A. Oliver has been appointed District Veterinary Officer at Aldershot, *vice* Veterinary-Lieutenant-Colonel H. Thomson, who embarks for India to take up the duties of Inspecting Veterinary Officer, Eastern Circle, Bengal.

Veterinary-Major J. Hammond is under orders to embark for Egypt, to take up the duties of Senior Veterinary Officer in that country.

Veterinary-Captain L. J. Blenkinsop has been transferred from 10th Hussars, Ballincollig, to the Royal Horse Infirmary at Woolwich.

Veterinary-Lieutenant W. F. Shore and G. K. Walker have joined at Aldershot for duty.

The annual statistical and general report of the Army Veterinary Department for the year ending March 31st shows that the health of our Army horses continues to be satisfactory, and consequently their efficiency is maintained at the standard arrived at some years ago. There is not much in the report that is noteworthy beyond the fact that the inefficiency from accidents and disease was a trifle less than in 1893, as was the mortality, which was highest in the months of September, August, March, and July, and lowest in January, February, and November. The average number of days each horse remained under medical treatment was the same as in the years 1891 and 1892—viz., twenty-one days. The surgical diseases and injuries were, as usual, the cause of the largest number of admissions; of 5,820 8 died and 106 were destroyed, 44 of the latter for fractures of limb bones. There was a large decrease in the admissions for diseases of the chest and air passages, due, no doubt, to the milder weather of the year. There were no cases of glanders, this being the sixth year in which that serious disease

has been absent from troop stables. Adenitis, or "strangles," as it is popularly designated, was not so prevalent as in the preceding year, and as this is a purely infectious disorder and can be suppressed this diminution is probably owing to the enforcement of sanitary measures. With regard to age in relation to health and mortality, the admissions to hospital treatment were great among young horses, gradually diminishing as they became more seasoned. The average age of all the horses serving during the year was two months more than in 1892, being 8 years and 11 months; the greater number were five years old, but there were 700 aged 16 years and upwards. In Egypt the admissions were increased, but there were no cases of glanders among the horses, though that disease was prevalent among the horses of the Egyptian army and police. In South Africa the admissions for the year were also increased, and the mortality was much greater, owing to an outbreak of "horse-sickness," an essentially African disease. The Army Vaccine Institute at Aldershot continues to be successfully carried on, the number of persons for whom lymph was cultivated during the year being 42,128 and this, with what remained from the last year, was considered to be sufficient for the vaccination of 45,857 people. Of this lymph enough for 43,064 individuals was issued. The results of 41,572 vaccinations are given, from which it appears that at home stations the percentage of successful primary vaccinations was 96 per cent., and of re-vaccinations 89·55 per cent. The results at foreign stations were not so good, which is ascribed with some probability to climatic influences. The number of calves inoculated during the year was 16, each calf giving, on an average, lymph for 2,633 persons. Since the establishment was commenced under the auspices of the late principal veterinary surgeon, Dr. Fleming, in January, 1889, up to March, 1893, lymph for 206,597 people has been prepared at a very small cost, that for the year we are now noticing being only £72 10s. 5d. The Director-General and officers of the Army Veterinary Department are to be congratulated on the success of their efforts to maintain its high reputation, as testified by the results given in this annual report.—*Lancet.*

Jurisprudence.

THE TREATMENT OF SIDE-BONE. INTERESTING CASE AT PERSHORE.

At the Pershore Petty Sessions, recently, William Bennett, 20, Washington-street, Worcester, was charged with cruelly illtreating a mare at Pershore, on August 9th, and with illtreating a horse at Strensham on August 12th, and a horse at Defford on the same date. Mr. G. New (Evesham) prosecuted, and Mr. J. B. Matthews (Worcester) defended. In the first case, Joseph Spiers, railway agent, Defford, said he owned a number of horses, including a mare named Darling. Witness saw the defendant at Defford, and had a conversation about the mare. The mare was not lame before it was treated by defendant. Defendant treated the mare for side-bone. Witness noticed the mare next day and found that the place had got very hard and callous, and that there was cracking round the hoof. A blister had formed, and corruption was discharging. The wound got worse, and it was worse that day than it had been before, as it now had an open wound. The mare appeared to be in very great pain, and walked with great difficulty.

By Mr. MATTHEWS: The mare had been suffering for two years from the side-bone, but had not gone lame. He had the operation performed to remove the side-bone. Witness did not know that his brother had written to defendant to perform the operation. Witness's brother was unable to be present owning to having had a stroke.

BEN TAYLOR, labourer, in the employ of Mr. Spiers, said he met defendant

in Pershore, on August 9th. Witness took the mare to Head-street and there saw defendant. Defendant took a bottle and brush, cut the hair off, and applied something out of a small bottle to the mare's leg, for about five minutes. Defendant told witness not to bathe it, and not to do anything to it at all. He saw defendant again in the evening, and defendant applied the same stuff to the mare. The stuff produced by Mr. New was similar to it. A few days after, witness noticed the hoof cracking all round where the stuff had been applied. He told his master, and they left off working the mare. It was a very bad wound.

By Mr. MATTHEWS: He never told defendant that the mare was lame at times. He remembered defendant saying that the mare's side-bone was the largest he had ever seen in his life.

AUGUSTINE HULSE, clerk to Messrs. Spiers, Defford, said he saw defendant on the Sunday morning, and Mr. Spiers introduced him as the gentleman who was going to attend to the mare. Defendant said he could cure a side-bone, and that the operation would not interfere with the mare working. He also said that it would not remove the hair. He saw defendant again on Monday at their office, with Mr. John Spiers. Defendant applied for the money for the work. Mr. John Spiers offered £5, but at last defendant accepted £5 15s. for that and two other horses. Defendant gave them the bottle of compounds (produced). He poured something out of a larger bottle into it. He said the stuff was worth £90. It was very valuable and would cure 45 horses. There was another substance given to him on Monday. This was to be dissolved and put into the wounds.

By Mr. MATTHEWS: He did not know that it was agreed that the charge should be £2 2s. for each horse. He thought the fee dear if the treatment was effectual.

WYNDHAM BRIEN, veterinary surgeon, Cheltenham, said he examined the mare on August 23rd at Defford. It had been treated on the outside of the off fore-foot. She was in great pain, and the hoof was very swollen. He again saw the mare that morning. It was too lame to walk, and the wound was swollen up the knee. This was caused by some strong corrosives, which were eating away all round the wound. It would be a very long time before the mare would be all right.

By Mr. MATTHEWS: There was pain caused by firing the side-bone, as well as by this treatment, but not so much. He thought the compound used consisted of sulphuric acid, and would not like to have any put on his hand after seeing the horse's feet. He had heard of Mr. Bennett's treatment before. Mr. Bennett treated a horse of Mr. Robson's at Cheltenham, which had two sprints when he treated it, but it had now a large wound and was in bandages. He did not know that the stuff produced was sulphate of iron. He never used it, as he did not believe in it. He believed the operation caused more pain than there was occasion for. He did not say the operation was a failure but did not believe the side-bone could be discharged. He would have liked the horses to have been brought there for the magistrates to see, only they were too lame.

By Mr. NEW: He could not say how long the mare would be incapacitated.

By General DAVIES: He believed it was impossible to cure a side-bone. The wound was extending to other bones, caused by the eating away of the tissues

Mr. STANLEY CARLESS, member of the Royal College of Veterinary Surgeons, practising as Worcester, said he examined the mare on August 28th. The wound was very unhealthy, and the mare was very lame. His opinion was that the treatment was useless. It was impossible to remove a side-bone.

By Mr. MATTHEWS: He admitted that it was possible for anybody but veterinary surgeons to find a cure for the side-bone. He understood that

defendant had been in hiding and he knew that Mr. Duncan had been to Worcester three times and could not find him. He knew of several horses in Worcester which defendant had treated and the result was the same as the others. He never knew that defendant had cured one yet. The wound was eating into the other bones of the foot.

MICHAEL YATES LEES, veterinary surgeon, Pershore, said he first attended the mare on August 21st. He found an unhealthy wound on the fore-foot caused by the treatment of some strong liquid. He had since treated it himself with soothing ointment. The liquid had completely killed the tissues. Defendant did not invite him to see him treat a horse with some of his ointment.

JOSEPH SPIERS, recalled, said he treated the chestnut mare with the lotion twice a day according to defendant's instructions until the place began to enlarge and the mare seemed in great pain. When Mr. Lees came up he gave him instructions to examine the animal professionally and to treat it professionally. The lotion was sulphate of iron. It was a great loss to them and he believed the treatment had ruined two of his horses.

In defence Mr. Matthews read a French paper which stated that defendant had treated a number of racehorses for side-bone at Chantilly (the French Newmarket) some of them valued at £20,000, and had entirely cured them with his wonderful invention. He called HENRY PERRINS, who said he had had 37 years' practice in Worcester as a veterinary surgeon. He was satisfied that apart from defendant's treatment there was no other cure for removing side-bone. Blistering and firing were the usual methods tried. Defendant asked his opinion of his treatment of a bad case in Worcester. The horse in question went very bad on its "toes" and was very lame. Defendant painted the wound with a hair brush and put it in the stable. The day after he painted it he had the wound cleansed with sulphate of iron. He saw the horse that morning. It was in no pain and went a lot better. He had never known anything of the sort before. He also saw Mr. Watkins, of the Unicorn Hotel, and Mr. Tom Smith, where he had treated and cured horses of side-bone. Witness, although surprised, was quite satisfied that defendant's treatment was effectual. The method adopted was far less painful than blistering or firing, as it was merely irritating. Defendant was getting well-known in Worcester, and never concealed himself. He believed that the stuff produced was the same as used by defendant.

THOMAS SMITH, horse dealer, Worcester, said some time ago he had a horse, which was very lame, treated by defendant for side-bone. Defendant painted it with the stuff before produced. The wound was now nearly healed, and he was surprised to see the horse cured so soon. He was thoroughly satisfied with the result of the operation. His brother had a pony which was similarly cured by defendant. He had heard of no failure from the treatment.

WALTER WATKINS, landlord of the Unicorn Hotel, Worcester, said he had dealt in horses for about 18 years. He had a horse suffering with spasms on July 6th, and so he saw defendant, who treated the horse in a similar way to the others. The horse had been to work for three weeks and was perfectly sound. He was very satisfied with the operation.

WALTER GRUNDY, butcher, Worcester, said defendant operated on the side-bone of his horse in a similar way to the others. The wound was now healing up.

JAMES GIBBS, Worcester, said he knew defendant very well. He lived with his wife and never concealed himself but went about the town. He did not know that defendant gave his address as the Post Office, Chantilly, France.

The Bench retired, and on returning dismissed the case.

After this Mr. NEW asked the magistrates to allow him to withdraw the other cases, which course was permitted.

Proceedings of Veterinary Medical Societies, etc.

THE CENTRAL VETERINARY MEDICAL SOCIETY.

THE last monthly meeting of the session was held at the Royal College of Veterinary Surgeons on July 5th. Mr. A. Prudames, the president, occupied the chair, and the other Fellows present were:—Professor J Wortley Axe, Professor F. Hobday, Professor J. Macqueen, Messrs. A. L. Butters, J. S. Hurndall, W. Hunting, F. W. Kendal, P. McOnie, F. C. Mahon (hon. sec.), H. G. Rogers, J. Rowe (hon. treasurer), F. Samson, W. Stapley, F. Orford Walpole, W. Willis, W. H. Williamson, T. J. Wooff.

The following Fellows were elected:—Mr. P. Vincent, Grays, Essex; Mr. Ulysses Carr, Royal Veterinary College; and Mr. A. V. Field, London.

Professor AXE read the following paper on—

LEAD POISONING.

Poisoning in the lower animals is a subject which from time to time forces itself on the attention of members of our profession, and also on occasions gives rise to a good deal of public interest, not to say excitement.

Especially is this the case when a Derby favourite or some sensational racehorse happens to be the victim of actual or supposed foul play. It is not an unknown weakness of the human family to suspect the human family of inhuman acts, and in the sum of life's affairs I know no matter in which this weakness is so recklessly indulged as in regard to the poisoning of animals.

Sudden death in our domesticated creatures appears to many to be a mode of decease for which they are altogether unqualified. To be told that a man has suddenly died of apoplexy or heart failure, is ordinarily sufficient to satisfy the most interested and bereaved of relatives, but there are some people, and among them not a few veterinary surgeons, to whose mind the sudden death of an animal brings with unerring certainty the idea of poison, and straightway the chemist is instructed to carry out a searching analysis, with the result that not one case of alleged poisoning in one hundred is affirmed by him. Heart failure and brain failure, and other pathological eccentricities, are events which the lay mind does not recognise as perils which beset the quadruped, and the professional mind often finds relief from exhaustive and critical inquiry in a declaration which shifts all further responsibility on to the shoulders of the chemist. The client, of course, having received assurance of the existence of poison, looks to the chemist for confirmation of the opinion of the pathologist, and this, I am entitled to say, he very seldom gets; not so much because the chemist is faulty in his methods, as because the practitioner is feeble in inquiry and precipitate in judgment. Now this want of thoroughness in the pursuit of related facts has frequently resulted in most serious losses to stock-owners, and especially in those instances, which are far too many, where anthrax has been mistaken for poisoning, for in those cases measures necessary to the prevention of the one are altogether disregarded in the delusive hope of finding some kind of satisfaction in pursuing the other, the result being that the disease spreads, and its seeds are sown broadcast over the soil to continue or resume their deadly work at some future time.

Nor is this all, for in many instances these unfounded declarations of poisoning cause suspicion to be cast upon innocent persons, and it is impossible to measure the social and moral degradation to which they may sometimes lead. I am prompted to make these remarks in the hope that they may be the means of drawing attention to a matter which not only reflects upon ourselves, but is often attended with serious injury to others.

As to lead poisoning, I have not selected the subject on account of its novelty, nor because it is unusually prevalent, nor because I have anything to say about it which others may not have said before me, but mainly because I

understood from your enthusiastic secretary that you were anxious to have something to talk about and to think about from one who was languishing for want of something to write about.

It is hardly necessary to say that poisoning by lead, although by no means of rare occurrence now, is much less common than it was thirty years ago. At that time the volunteer force was in its infancy, and rifle practice was carried on to a large extent in pastures adjoining provincial towns, and the herbage in consequence became contaminated with bullet spray. Large quantities of the metal found its way into the stomachs of cattle, and sooner or later produced its toxic effects.

Numbers of the veterinary profession in various parts of the country drew attention to this new danger, with the result that our rifle ranges were removed to more suitable situations, or guarded against the encroachment of stock within the splashing range of bullets. Legislative measures dealing with the pollution of rivers and the escape of noxious fumes from smelting works have, no doubt, had the effect of diminishing to some extent the amount of lead poisoning which formerly prevailed in certain districts. Moreover, the danger which belongs to lead in its various combinations has become more widely known to stockmasters and others, and precautionary measures against its ingestion by cattle are more strictly observed.

Notwithstanding this, plumbism does, and will continue to appear from time to time, and it cannot be otherwise than advantageous to review the clinical and pathological facts which pertain to it.

The sources whence animals may obtain lead in poisonous amount are many and various, and should always be present to the mind of the veterinary practitioner in dealing with cases clinically suspicious. A thorough acquaintance with the facts of lead distribution may afford valuable help in periods of doubt as to the etiology of certain neurotic affections in our farm animals.

In lead-smelting districts, outbreaks of lead-poisoning in farm stock are not uncommon. Here roads and garden paths are frequently repaired with broken "slag," which, in the form of road scrapings, is sometimes used as a spring dressing for pasture land, the result being that the metal, in fine division, is ingested by cattle with the herbage, eventuating in plumbism. In Derbyshire, where large quantities of grains are pitted in the autumn for winter use, it is the practice of some to cover them down with earth, and we have known considerable sickness and mortality to result where road-scrapings containing slags have been used for this purpose.

Pastures in the vicinity of lead works suffer serious contamination with salts of the metal driven off from furnaces in the operation of smelting, and white lead factories also afford examples of the pernicious effects of this salt on animal life acting through food and water. The last case to which our attention was directed had its origin in the pollution of water by lead carbonate, which, as dust, had been carried into an open tank.

In the lead-mining districts of Cornwall and Wales, many cases of disease and death have resulted from the overflow of rivers into which refuse has been cast from the washing of lead ore.

Paint may be said to rank as one of the most fruitful causes of lead poisoning, especially in bovine animals. This substance, which chiefly consists of the carbonate and oxide of lead, becomes accessible to farm stock in various ways. It is conveyed on to our pastures in manure from the building and painting establishments of our large towns. As spring comes round the cottager and country carpenter clean out their paint pots, and not unfrequently cast the refuse over a neighbouring fence, later on to be gathered up as a dainty morsel by some unfortunate cattle. At this period of the year, too, country houses are being done up, and gates, posts, fences, and farm implements receive their periodical coat of paint; hence it is that spring

invariably brings with it reports of lead poisoning in agricultural districts remote from mines and works. To cattle, paint is a delicacy which they cannot resist, and and neither harmony of colouring nor artistic merit commands respect from them when they have determined its removable presence.

Water contamination now and again affords most pitiable examples of chronic plumbism. This is more especially the case where the joints of tanks have been "stopped" with putty made up of lead carbonate, or where, in the repair or adjustment of pipes, this compound has been allowed to enter them, or to be unduly exposed to the water they carry.

The action of water directly on the metal rarely in itself gives rise to pollution dangerous to farm animals, but it is, nevertheless, a possible source of danger which the etiologist and the sanitarian cannot consistently disregard.

It must always be of interest to those who are engaged in unravelling the mysteries of disease, to study the influences which lead up to and determine the final conditions of causation. The causes which impart to water its solvent action on lead have been variously stated, and up to the present time the chemist has appeared to hold the field in the solution of the problem. Recent research, however, tends to indicate that the final words in this important question must await utterance by the biologist and the physicist. In the former connection Dr. Robert Smith has established the fact that the life processes of certain micro-organisms infecting moorland waters result in the development of an acid, and from facts obtained in course of inquiry into an outbreak of lead poisoning at Sheffield there is reason to believe that the plumbo-solvent action of a particular section of the Sheffield water was due to this cause. If this be so another item of sanitary importance will have been added to the nature of the gathering grounds whence water supplies are derived. From a sanitary point of view it is desirable to notice the conditions which influence the solution of lead by water. In this regard it is to be observed that although all descriptions of this metal are liable to be chemically acted upon, new lead, whether in the form of pipes or tanks, more readily undergoes solution than does that which has been in use for some time. The plumbo-solvent action of water, however, depends not so much on the state of newness or oldness of the metal, as upon the chemical properties of the water with which it is brought into contact, and the physical conditions, especially, perhaps, as to temperature and pressure under which it acts. Chemists are generally agreed:

1. That the natural waters which act most forcibly on this metal are among the purest of their kind; and besides possessing the quality of softness in a high degree, are at the same time largely charged with oxygen.

2. That those waters which contain an abundance of earthy salts, and which are known as hard waters, are least capable of plumbo-solvent action. While recognising these truths, it must at the same time be understood that all soft waters do not act upon lead, and that some do so only in an inferior and a harmless degree. Moreover, it has been noticed that the time during which this action continues differs in different samples. In some the solvent power soon becomes exhausted, but in others it is continued for long periods, and may in the course of its continuance acquire increased solvent action.

Exceptions are also to be found in regard of the rule pertaining to hard waters. In this class, generally so indifferent to lead, some examples are known to act upon it with considerable energy. But of the many features concerning the plumbo-solvent action of water none are so interesting and remarkable as that which relates to its diminution or disappearance in transit from one place to another. In this connection Mr. Power observes: "The water supply of Glasgow, where samples are taken in Loch Katrine, is found to possess very vigorous and sustained action on land, whereas this same

water as delivered from the town mains has been found to have very insignificant action on lead pipes, and, as a matter of fact, lead poisoning by the water service is not heard of in Glasgow." . . . . "Glasgow is some twenty-five miles from Loch Katrine, and the time occupied by the water in passing thence to the city mains is ten to twelve hours. The opportunity thus afforded for modification of the Loch Katrine water is considerable, so that the question arises, whether the obscured diminution or abolition of its plumbo-solvent property is due (as is believed) to chemical action on it of the the sandstone or limestone conduit conveying it, or to other and obscure influences."

"In the case of Glasgow water we must admit something beyond the material used in the construction of an artificial conduit may be concerned in the observed loss of plumbo-solvent ability, inasmuch as a similar loss of solvent action on lead of Loch Katrine water is discernible after it has flowed a few miles from the lake by its natural outlet; and in the case of other originally plumbo-solvent waters we meet with the fact that not a few rivers mainly arising from lakes whose soft waters act freely on lead, and traversing very various geological strata, furnish public water-supplies having little or no plumbo-solvent property, whether tested by laboratory experiment or by immunity of lead poisoning of consumers of the waters. Can it be," asks Mr. Power, "that mere delay of a soft water—by mechanical means, for instance, affording time and opportunity for filtration of the water, for exposure of it to light and air on weirs or in shallow channels and the like—in its passage from its collecting ground to its distribution in a town, goes far to rob it of any plumbo-solvent property it may originally have possessed?" These are problems which may at present appear to have but a scientific interest for the veterinary sanitarian, but we are not in a position to say that their solution is altogether void of practical importance; for out of the unconsidered trifles of to-day may be evolved the greatest scientific achievements of to-morrow.

To the veterinary practitioner and the stock-owner it is especially important to bear in mind that the action of water on lead and its compounds is greatly intensified by the presence of decomposing vegetable matter, and since the sources whence farm animals derive their supply are mostly in a state of organic contamination through the presence of leaves, parts of trees, and decaying aquatic plants, the possibility of danger from this canse requires to be considered in all cases where clinical indications of plumbism are present. Let me give you an illustration, not only of this fact but of the etiological subtlety, which now and again surrounds the disease. Some time ago we were called upon to inquire into an outbreak of disease in a valuable stud of thoroughbred stock. The malady had been in existence between three and four years, and resulted in such havoc among the yearlings, as to render the continuance of breeding impossible under the circumstances then existing. Several veterinary experts had been consulted from time to time, and many and various opinions had been expressed as to the nature and origin of the disease. Among other causes it had been referred to ill-constructed stables, by some to deficiency of lime in the soil, by others to rheumatism, and one authority suggested as an alternative to the latter opinion that it might have lead for its origin.

Inquiry into points of possible relation to the opinions expressed did not appear to give support to any, save to that which attributed the disease to plumbism, but even here no sort of confirmation had been afforded from etiological data. The history and clinical characters of the affection could not be reconciled with anything else than lead poisoning, and acting upon this view of the question. inquiry was directed to a considaration of all that pertained to food and water antecedent to and during the period since the disease first appeared. The investigation had not proceeded far when it was found

that food could be safely excluded from any concern in the matter, and attention was thereupon directed exclusively to the consideration of water and possible sources of contamination. The history of the water itself was a very simple affair, but how it became contaminated and how it escaped detection were questions for which up to this time answers had not been forthcoming.

During and antecedent to the outbreak of the disease the water supplied to the stud was rain water, which had been collected from the roofs of stables and conducted by iron spouting into a large wooden tank. The place being in the country and far away from any possible source of atmospheric pollution, such as might exist in proximity with smelting works, it was taken for granted that the rain when it reached the buildings, was in a pure condition, and that any contamination pernicious or otherwise which it might have undergone had occurred either on the buildings, or in the tank, or in the conduits which conveyed it from the one to the other. Inasmuch as the latter consisted of iron piping, in which no sort of lead had been employed in fitting or repairs, the idea of finding any explanation of the outbreak here was soon abandoned. An examination of the roofs revealed the existence of three or four short lengths of lead guttering, and this for a moment claimed consideration, only, however, to be set aside as inadequate to occasion alone the serious pollution which must have existed to give rise to such fatal results.

The tank had been emptied and thoroughly cleansed, and this appeared to have been sufficient to disarm suspicion as to its possible concern in the outbreak, and we were assured again and again that the tank was free from harm and could have no possible connection with the disease. We were told that it had at no time been repaired, and being constructed of wood it could not therefore convey lead to the water; but, we urged, if our diagnosis is a correct one and our conclusions as to the insufficiency of pollution from any other source are warranted by the facts, then the offending matter must be found in the tank. The tank was therefore entered and submitted to a most careful examination in every part, with the result that a large quantity of putty-like matter was found in the joinings of the vessel, and this on analysis was subsequently found to be mainly composed of white lead. The sedimentary matter which had some time previously been removed from the tank was now sought after in an adjoining copse and recovered. This was found to consist of a large accumulation of decomposing leaves which had been washed from the roofs of the stables, together with a quantity of black vegetable sludge. Here, again, analysis brought to light lead in such amount that beads of the metal of considerable size could be readily obtained from it.

Thus ended the mystery which for nearly four years had hung over and impoverished this unfortunate stud. It is not to be understood that the water in this case would have proved harmless in the absence of decomposing vegetable matter, but there can, I think, be no doubt that by its presence the solvent quality of the water was greatly intensified.

I am glad to have an opportunity of putting this case on record, because it shows how much our success in etiological research depends upon a close observance of detail, and how desirable it is that patience and perseverance should attend upon well-grounded convictions.

The clinical phenomena which characterise the acute form of the disease present a great contrast to those exhibited in the course of a chronic attack. It is comparatively seldom that acute lead poisoning is seen in the horse, while in the ox it is a common form of the disease. This difference has no doubt relation to the physiology of digestion.

Primary mastication in ruminants is so far incomplete as to allow of the unconscious digestion of metallic lead and other foreign matters, against which the horse is guarded by the more thorough and complete comminution which

the food undergoes. Then as to the salts of lead, cattle are notoriously fond of them, and in the form of paint have frequently been known to consume large quantities. In one case in our own experience a heifer ate nearly three pounds of white lead and died in thirty-six hours.

The symptoms of plumbism present wide differences, both in severity and in kind, in different cases: this depending partly on the temperament of the animal, and partly also on the form and quantity of lead received. Young animals suffer more severely than older ones. Our experiences in this connection go to show that foals and even yearlings will die from the effects of lead in such quantities as produce no perceptible impairment of health in their dams. With regard to the course and duration of the disease, wide differences are noticed in different cases. In one the malady is sudden in its onset, severe in its action, and speedily fatal. In the other it commences as an obscure, ill-defined ailment, marked by a progressive anæmia extending over many weeks or months. In this chronic form of the malady it is impossible to put a limit to its duration. Experience shows that it may continue for any period between a few weeks and twelve months, and we see no reason why even the last-named period should not under certain circumstances be exceeded. Acute lead poisoning usually follows upon the ingestion of large quantities of some salt of lead, most commonly the carbonate or red oxide in the form of paint. The chronic form of the disease most frequently results when smaller quantities of such salts are periodically consumed with food or water, or when, as in the case of cattle especially, lead in the metallic state gains access to the stomach and undergoes slow oxidation and absorption. In saying this much it is not to be understood that metallic lead is incapable of inducing acute plumbism. As to whether it will or will not do so depends upon the amount and condition of the metal ingested. Where it is received in that form termed sheet lead a much larger surface of the metal is exposed to the action of the digestive secretions, and the quantity dissolved will be greater for a given time than where it exists in solid masses.

The clinical phenomena in acute lead poisoning are mainly those of great nervous depression, or excitation, or both consecutively, accompanied with disordered locomotion. It is, indeed, essentially a neurotic affection involving the brain and spinal cord as well as the sympathetic system. The first obvious signs of the disease are dulness and listlessness with an indisposition to move or be moved. The affected animal stands in a fixed position with head depressed, pendent ears, and drooping eyelids. The face is void of expression, and the cheeks and lips are flaccid, and in some cases imperfectly under control. The pulse is but little or not at all disturbed, and in some instances slower than normal; the respirations are somewhat increased but shallow. Food is altogether refused, the bowels are torpid, the hair stares, and the secretion of milk in the cow is impaired or altogether arrested; the conjunctival membrane, although pale in the early period of the attack, soon becomes injected, as do also the vessels of the sclerotic. A discharge of tears frequently flows from the eyes, and saliva from the mouth. The teeth are forcibly ground, and convulsive fits, slight or severe, recur at shorter or longer intervals, and the gums have been said by some to present a blue discoloration.

In a large number of cases of both acute and chronic lead poisoning in the horse and ox I have not yet met with a single instance in which this phenomenon, common in the human subject, has appeared. In the further progress of the case dulness deepens into stupor and later into coma. The horns, ears, and legs are now cold, the breathing is laboured and accompanied with a moan; twitching of the superficial muscles is noticed here and there; the movements become more and more unsteady, and end in complete paralysis. The animal now lays on the side, with head and legs extended,

and after one or several convulsive seizures succumbs to the effects of the poison. In other cases the course of the disease is somewhat different. Here, after a brief period of dulness and stupor, succeeds one of restlessness and excitation, which may proceed to delirium and frenzy. The animal paces the yard or box, walking slowly round and round, usually in one direction. The pupil is dilated and impairment of vision is shown by the head being struck against the wall or some other fixed object in the animal's wanderings and delirium. Where resistance is met with the patient will fix his head against the obstruction and steadily or forcibly press forward, and continue to do so until he becomes exhausted, and falls or lapses into a state of coma. In this condition he remains for a longer or shorter period, and on being roused resumes the rotatory movements as before. In other cases, or at different stages of the same case, while the head is being forced against the wall symptoms of delirium appear, and the force used may be such, as in the ox, to break away the horns. The resistance appears to add to the excitement, and the animal bellows and furiously paws the ground. At this time the mouth is open, the tongue protrudes, saliva hangs from the lips, and the beast wears a wild and frenzied look. If in the open it gallops wildly about until stopped by some impediment, when it falls from exhaustion. In other cases, again, the patient knuckles over at the knees and fetlocks, and in some instances will occupy the kneeling posture for a considerable time while in a semi-comatose condition. The duration of an attack of acute lead poisoning varies from thirty-six hours to four days; less severe attacks may extend over six to eight days.

(To be continued.)

SOUTHERN COUNTIES VETERINARY MEDICAL ASSOCIATION.

(*Continued from page* 218.)

Mr. SIMPSON said that in the locality in which he resided anthrax was almost unknown, although Professor Axe said that the disease was now on the increase. Professor Axe had laid great stress on the importation of foreign hides and the cleansing of foreign wool in same localities as a frequent cause of anthrax. In his locality there were neither hide factories nor wool-preparing factories, and he was inclined to agree with Professor Axe on this point, that anthrax was largely caused by these industries, or at any rate that these industries had a great deal to do with it. Professor Axe had also said in reply to a remark made by Mr. Singleton, that it was necessary to take action with regard to the importation of foreign hay. Whether the spores could be carried from a foreign country to our own in foreign hay was a question he (Mr. Simpson) was not in a position to answer, but taking into consideration that they had been shown by the President certain acari which he had obtained from foreign hay, it was a question whether it were not advisable in the interests of agriculture, to prohibit the importation of foreign hay. On account of the scarcity of English hay they had been having foreign hay during the last twelve months and perhaps there were some connection between the increase in the quantity of foreign hay and the increase in the cases of anthrax. With regard to the germs of anthrax living on certain lands for a length of time, he might say that the only cases which had occurred in the county of Bucks in the last twenty years had occurred in the same neighbourhood. In the last outbreak a bullock was the first to be affected, then a horse, and then a dog, although a dog was supposed to be proof against this disease. There was no mistake at all about the cases being anthrax, and they occurred on low-lying grounds. With regard to the early history of the disease, he knew of no accurate guide as to diagnosis, and as far as he knew, it

was impossible to say until after death whether the disease was actually anthrax. But he should say that a previous case of anthrax having occurred in a herd, the rising of an animal's temperature to 105 degrees might be taken as a sure symptom of anthrax, and it would be perfectly safe to destroy it as a subject of anthrax. It was extremely unfortunate that the anthrax bacillus did not make itself observable until about the time of the death of the subject. What the anthrax bacillus was like under the microscope they all knew from the excellent specimens that had been shown them that afternoon, and there should be little or no difficulty in determining whether the animal had died from anthrax or not. In the early stage of the animal's sickness it was possible to mistake for anthrax the less severe disease which was known as "black quarter," but they had had it explained to them that the anthrax bacillus had slightly rounded ends, whereas in the disease known as black quarter the bacillus had distinctly rounded ends. But unless they had perfect forms of each bacillus, a beginner in microscopical work might easily be led into mistaking one for the other. As to preventive measures, Professor Axe had spoken of making use of attenuated anthrax virus, and in connection with this there was an extremely interesting paper read at the last meeting of the National Association by Mr. Dollar, and he had quoted from undoubted authority that an ox treated with this attenuated virus had been rendered immune to anthrax. In his method of preparing this attenuated virus he had begun on a sheep, and then on a guinea-pig, and so he went on attenuating the virus until he reached the least susceptible of all animals, the mouse, and then he had returned to animals higher in the scale. He had pointed out the importance of understanding this disease, because it was so easily communicated to man. As a proof of the possibility of its being so communicated, he would mention that at their last meeting there was a gentleman present who had been a victim to anthrax. Fortunately, Nature was so kind that in the human system anthrax was not so dangerous as in the lower animals. In a human being it was localised, and it might be treated locally. The gentleman to whom he referred was a member of their own profession, and he caught the disease in the course of his professional duties. But the disease was localised, and was treated locally, and he was happy to say that their friend had made a good recovery. As to the making use of the meat affected by anthrax, no doubt it was highly improper. The sooner an animal dead of anthrax was burned or buried the better, and as burning was so much better than burying, he thought it was the duty of the authorities to provide portable cremation apparatus for the effectual burning of the bodies of diseased animals. In the absence of such means the best way was to get the animal as far underground as possible as quickly as possible, burying the body in quicklime. With regard to the destruction of animals he thought that the better way was to inject prussic acid into the jugular vein. But that was a very wide subject, upon which every member of the Association possibly had different opinions. He regretted that Professor Axe had not been able to be amongst them that afternoon, that he might defend the paper which he was so good as to read at the last meeting. He hoped that at the termination of the discussion a very hearty vote of thanks would be given to Professor Axe for that paper.

Mr. BAKER hoped that the county council would take some steps to provide a portable cremating apparatus for use in the destruction of animals which had died from anthrax, or from any other disease for which it was necessary to obtain a speedy destruction of the body, which was far better than the method of burying the bodies in shallow graves with a mere sprinkling of quicklime. In nine cases out of ten the method of burial was not properly carried out. If they destroyed a body by means of fire, they knew that there was no possibility of future infection. He certainly thought that every county

should have such an apparatus. He did not know what the expense of each apparatus would be, but he did not think it would be so great as to be prohibitive, and the apparatus would do for other infectious cases such as swine fever, etc.

Mr. J. D. BARFORD said that unfortunately for himself he was not present at the previous meeting when Professor Axe read his paper, or he would have gone more deeply into the subject, which was of such vital importance to agriculturists. But he would take that opportunity of saying that in electing their friend to the chair they were doing the right thing. He should certainly have been very sorry if he had been passed over. He was a gentleman exceedingly worthy of the position, and one who had gone more deeply than most of them into the scientific matters he had touched upon that afternoon. With regard to anthrax, he had had very little experience of it; Mr. Redford had had more experience, perhaps, than any of them, and had been an eye-witness of the destruction of 160 head of cattle. He could not trace any single case of anthrax to imported hay, but he felt that that was a very probable cause. It behoved them as professional men to be very careful in their manipulation of this disease, lest they might inoculate themselves. They had already seen a case of one member who had been very nearly losing his arm. They could not be too careful.

Mr. J. W. BARFORD was sorry that he was not present at the reading of the address by Professor Axe at their last meeting, for he would have liked to have heard what was suggested for preventing the disease.

The PRESIDENT said that as to the question of the value of attenuated virus, it had been successfully used on animals on the Continent, and those animals had never been attacked while others close around them had been. There had been cases in which virus had been used which had not been properly attenuated, and had caused the death of the animals upon which it had been used. As for the spores of anthrax, they could exist on grass, potatoes, or on leaves. When an animal was killed a very small portion of the spores existing in a field were killed. Professor Axe, in his paper, had expressed the opinion that the bacillus of anthrax was taken in with the food of the animal, while those of pleuro-pneumonia were taken in with the air breathed; so that it seemed to him that slaughtering, though of great value as regarded pleuro-pneumonia, was not of much use to prevent the spread of anthrax. But there were one or two points in Professor Axe's paper that were not quite clear. He was not sure whether the Professor was in favour of moving a herd in which anthrax had been discovered, or whether he was not. He, the President, considered the prohibition of movement from an infected place a great mistake. The Professor admitted that disinfectants were useless, and yet he advised their use. His own opinion was that they would find out more about anthrax by a closer study of the parasite and the vegetable world. They knew that the animal and the vegetable worlds were inter-dependent, that what one gave off the other took up, and he was inclined to think that the safeguard against anthrax might be found in the larvæ of dipterous insects and in the vegetable kingdom, and he would suggest a trial of the planting of woods on those areas on which cattle were commonly attacked, as a preventive measure.

Mr. SIMPSON said that Mr. Barford had asked to have the statistics to show that vaccination was of any use in preventing anthrax. He had Mr. Dollar's paper with him which showed the results in France. In the year 1882 22,916 cattle were vaccinated, and amongst these the death rate was ·35 per cent., although previously the death rate had been 5 per cent. In the same year 243,199 sheep had been vaccinated and the death rate was 1·08, although the death rate in the previous year had been 10 per cent.

Mr. J. D. BARFORD moved, and Mr. J. V. Blake seconded a vote of thanks

to Professor Axe for the paper which he had read at the last meeting, and the vote was carried unanimously, as also was a vote of thanks to the chairman, proposed by Mr. J. F. Simpson, and seconded by Mr. J. T. King.

The question of the place of the next meeting was considered, and on the motion of Mr. J. D. Barford it was decided to hold it at Basingstoke.

LINCOLNSHIRE VETERINARY MEDICAL ASSOCIATION.

(Continued from page 196.)

Mr. JAS. SMITH congratulated the President on the happy position in which he found himself, and also congratulated the Lincolnshire Veterinary Medical Association in having such a President. He was very sorry Mr. Hunting was not there as he should liked to have thanked him personally for his excellent paper and for the kind way in which he had responded to his invitation to give them that paper, the subject of which he had the pleasure of suggesting to Mr. Hunting. There was one remark made by Mr. Hunting to which they as country practitioners could scarcely agree. He fancied Mr. Hunting said that the majority of cases of fracture were caused by direct injury and not by muscular action. His experience he thought showed that fractures were due very much to muscular action and not to direct injury outside. A horse shied at a piece of paper and fractured the os suffraginis. A horse was seen to play in the box and fall to the ground, having fractured the os corona in eight pieces. As to deferred fracture, a mare he knew very well was being driven along a road and slipped in a rut and went very lame. She was driven a fortnight afterwards and was sometimes sound and sometimes lame, but he gave his opinion that she had a broken leg, and would have to be shot. She was kept for three weeks after that and at the end of that time she got down. She was shot and it was found that the femur was broken into pieces. Talking about plaster of Paris bandages, a mare fractured her pastern jumping over a hurdle. Her foot was turned round, but the mare, with a plaster of Paris bandage, made a sufficient recovery to walk a considerable distance, and was turned out in the park and bred from. He did not doubt but that was the action of the muscles on the bone that caused that fracture. There was a case of compound fracture of the metacarpal bone of the calf. He took the leg off below the knee and the calf got so fat on three legs that it had to be killed. The most ghastly fracture he ever saw was in the case of a horse playing about behind a cart on which was a ladder. The horse struck the ladder and the frontal bone was smashed in and one eye pushed out, and the brain was only just covered. If they closed the horse's nostrils he could breathe through the wound in his head.

Mr. MACKINDER said Mr. Hunting's paper had afforded him very great pleasure. He had met with several cases of deferred fractures, and one he remembered specially was a case of a cow which met with an accident, and walked for three or four days. She was very little lame and grazed about, but about the 4th day she went very lame, and the boy said he had heard a crack like a gun, and it was found there was a fractured bone, but there was nothing to see. It was turned out and broke down, and it was found that the pedal bone was completely fractured. He understood that Capt. Russell said they very rarely got a bony union when they had fracture of the ulna or radius, but he could show him a case where there was a complete recovery. He thought the less they slung them the better. As to fracture of the base of the skull, a foal intended to be shown was taken to be shod. It fell backwards, and fractured not only the base of the skull, but also the wing of the atlas. He applied ice, but he lay insensible for two hours. That foal was also blind of the near eye. The os suffraginis or pastern bone might heal

itself. He remembered a case of a groom who was leading a mare when it fractured that bone. He plastered it up, and the mare had been breeding since. She broke that leg completely in two, but it was set, and was as good as could be. A man accustomed to bone-setting told him they kept on boiling starch until it formed into glucose, and that would set as hard as anything. He understood that was frequently used on the human subject, and among those people who made bone-setting a speciality.

Mr. FREER narrated one of the most interesting cases of deferred fracture that had come under his notice. It so happened that a few days ago a hunter was brought home very lame, and he saw him the following morning. There was a swelling between the knee and the elbow, and he told the people that the bone was seriously injured, if not fractured. In the course of a week the horse made considerable improvement, but they allowed the horse to lie down, and they found the radius sticking through the skin. As to deferred fractures, he produced the metatarsal bone of a four-year-old hunter that fell lame in jumping a fence. He was walked home, over four miles, and he bound it up tight with a calico bandage. That he diagnosed as a case of fracture of the os suffraginis. He attended next morning, and bound it up, and found a little swelling on the metatarsal bone, and then it occurred to him that the metatarsal bone was cracked as well as the os suffraginis. He got him into slings, but seeing that he was doing more damage than good in them, he removed them. They kept him for some time, and he was very much improved. Soon after he got a telegram, and found the horse had got down in the night and knocked against the wall, and so brought on the fracture. In the case of the os suffraginis of a five-year-old horse of a medical man, he diagnosed a split pastern, and he applied acetum cantharides to the joint. He produced the dentata of a six-year-old horse, showing extensive osteo porosis, and the bone from the atlas to the sacrum was covered with periosteal deposit. A pair of horses were cutting grass, and the mare put her foot into a depression, and smashed the tibia into 50 bits. As to fracture of the base of the skull, ten yearling colts were kept up for castration, and one of them got away and smashed his skull to atoms.

Mr. DICKINSON said with reference to the little experiment spoken of by Captain Russell, for administering chloroform to the horse by the new instruments, he had found it most useful for producing anæsthesia in the dog, and he used ether; but he did not think it was of any good for horses. As to fractures, his success in setting had been great. He had a photographed group in his establishment of 27 horses which were at work in his district, and they had all had fractures, and they had all been treated in the same way, in slings. In the case of a horse worth £400 or £500, brought to his place with a fractured tibia, he said he had put him in slings, and described the mode of treatment. The bending over, spoken of, could be obviated by strong webbing. He also suggested how shortening could be avoided, and said he never destroyed, but he would have the animals brought to his infirmary, and he believed that by mechanical contrivances, many horses that were now shot, need not be destroyed, but could be put right. In one case (specimen produced), he thought the fracture was owing to the condition of the bone, there being a great deficiency of some natural element in it; and they could not say whether this was due to concussion or muscular contraction. He believed the majority of split pasterns were due not to muscular contraction, but to concussion. He congratulated the President on the position he occupied, and was glad to hear him refer to the Defence Society, there being no society which was more useful to the veterinary surgeon.

Dr. BENSON said for the human subject they now produced anæsthesia by ether-bromide before using chloroform.

The PRESIDENT produced specimen of fracture of the head of the femur, and said he diagnosed fracture of the acetabulum by the peculiar rise in the gluteal muscles. He also showed two cases of fractured pasterns. One was a fracture, and the other was only a slight crack, and had that latter case gone into the knackers' yard, it would probably not have been seen. He also showed a specimen of fractured sessamoid. The upper fracture was of recent date, and the lower had been done previously. He had known cases of fractured pasterns recovering, and eight years ago a mare broke her back, and she lived for eight years, the bones being all fixed together. As to deferred fractures, he had known several cases where the horse was only walking slightly lame. In one case he could feel a fissure, and he diagnosed fracture of the tibia, and that horse went out to walking exercise every morning. Ten days after he went again, and the leg was swinging, and on dissection, he found the top broken into seven or eight pieces. He always treated with very great respect a kick on the outside of the arm, or on inside of the thigh.

Mr. WESTON cited a case of fracture of the hip joint, which he put into slings for three months, and the mare got quite sound, but afterwards got down and ricked her back.

Mr. GRESSWELL cited a case of a fractured metacarpal in a mare, the bone protruding through the skin. In that case he amputated the leg, and the mare, which was due to foal in about a week, foaled directly. He dressed the mare, and attended to her, and she brought the foal up. In a case of broken sessamoids, he held that was due to muscular contraction and not to concussion.

The SECRETARY, by the unanimous wish of the meeting, was directed to write to Mr. Hunting, thanking him in the name of the Society for his very excellent paper, and expressing a hope that his absence on that day might be atoned for on many future occasions.

Mr. FREER then proposed a vote of thanks to the President for his conduct in the chair.

This was seconded by Mr. GOOCH, and the President having suitably replied, the meeting terminated, and the members and visitors adjourned to dinner.

After dinner the usual loyal, patriotic and professional toasts having been given, Mr. Freer said he thought they ought not to separate without expressing their sympathy with one of their honorary members, Professor Walley, in the very severe loss he had sustained by the sad death of his son. He was sure Profesor Walley had the heartfelt sympathy of every member of the Society, and he proposed that the Secretary be directed to express to him the condolence of the members there present.

This was seconded by Mr. DICKINSON, who said that he retained very pleasant memories of his friendship with Professor Walley during his college career in Edinburgh, and supported by Captain RUSSELL, and carried unanimously.

The toast of "The Medical Profession" was responded to by Col. POWELL and Dr. BENSON, and that of "The Visitors" by Ald. G. HUNTING and Councillor JOS. HUNTING in an entertaining speech. The health of "The Host and Hostess" terminated the proceedings.

JOHN A. ROBINSON, *Hon. Sec.*

MIDLAND COUNTIES VETERINARY MEDICAL ASSOCIATION.

A QUARTERLY meeting of the Association was held at the Grand Hotel, Birmingham, on August 14th, the chair being occupied by the President, Mr. H. Olver, of Tamworth. There were also present: Professor Williams,

Messrs. Malcolm, Stanley, Gibson, Parker, Blakeway, Birmingham; E. G. Crowhurst, Leamington; Simpkin, Market Harborough; Cole, Hinckley; Over, Rugby; Collett, West Bromwich; Gold, Redditch; Barling, Ross; Perrins, Worcester; Huband, Cheltenham; Gooch, Stamford; Grasby, Daventry; Beddard, Cartwright, Wolverhampton; Barrett, Nuneaton; Wartnaby, Burton-on-Trent; Burchnall, Loughboro'; Coe, Stoke-upon-Trent; Wragg, London; Taylor, Stourbridge; W. H. Brookes, Handsworth; and H. J. Dawes, Hon. Sec., West Bromwich. *Visitors.*—Messrs. Lindley, Rutherford, Green, Franklin, Hopkin, Mason.

The HON SEC. read letters of apology from the following:—Professors Walley, McCall, Macqueen, Penberthy, McFadyean; Dr. Fleming, Sir H. Simpson, Messrs. Pritchard, Trigger, Smith, Green, Bainbridge, Russell, Merrick, Blunt, Tailby, and others.

The question of insurance companies' fees was discussed, and it was generally admitted that these were too low. It was finally decided that the resolution passed by the Eastern Counties Association be adopted by this society also.

Professor WILLIAMS gave an address on

"SOME DISEASES OF THE SKIN."

He said he was overwhelmed with the responsibility of so doing, because he stood before a body of veterinary surgeons who probably knew quite as much, if not more about the subject than he did himself. He had prepared a few notes upon the diseases of the skin, but he confessed to being a bad reader, and was therefore induced to give them a sort of lecture rather than to read them a paper, to which they were previously accustomed. To take up the study of a book on Dermatology, no matter by whom written, was apt to confuse the best in the world. It seemed to be a study in itself. There were full courses of lectures in London devoted to skin diseases of the human being, whilst in veterinary practice they would also require a session of study.

To his thinking the arrangement and classification of diseases by writers on dermatology were most confusing, and it was a matter of the greatest difficulty, particularly for young men, to make head or tail of them, because the classification was simply descriptive of the symptoms of the disease, without giving any idea as to its pathology. He himself had therefore tried to arrange some common-sense classification of skin diseases, and he had grouped them into two great orders. 1st, Non-Parasitic disease, that was to say, diseases due to non-parasitic causes; and, 2nd, Diseases which were due to parasitic causes. Then he sub-divided the non-parasitic diseases into (*a*) Inflammatory; (*b*) Non-Inflammatory; and (*c*) New formations, although the last-named might be done away with, because it could be placed either under the inflammatory or non-inflammatory head. Parasitic diseases he subdivided into two kinds, namely those due to animal parasites and those due to vegetable parasites.

Then, again, he endeavoured to arrange inflammatory diseases as representative of the inflammation, and whether arising from internal or external causes, they might be compared to conditions artificially induced by irritants. For example, if one applied a moderate quantity of mustard, it induced redness of the skin. "Erythema" or inflammation of the external layer of the dermis, seen in the colourless parts of the skin, such as white heels, etc. He would first describe mere redness. It might be due to wet, cold, etc., about which his hearers knew as much as he did. Even that condition was induced by internal causes, and the most familiar example of it was what the old farriers, to whom he desired to pay a high tribute of praise, called "Surfeit," which term was a very descriptive one, and gave them a much better idea of the nature of the disease than the term which was at present applied to it.

It was also called nettle-rash, but its scientific term was Urticaria. It most frequently arose from a sudden change of diet, which caused some irritation or mal-condition of the digestive organs, and was, although very rarely, a concomitant of colic. It consisted of an eruption of elastic eminences, rounded or oblong in shape, and attended sometimes with severe prurigo, although sometimes the prurigo was very slight or even absent. The attack is often very sudden, the horse seeming perfectly well and then in an hour or more he is found covered over with blotches. He had seen cases where there was no irritation, but lumps appeared all over the body. They were hot to the touch and if the skin were white, the redness on the surface could be distinctly seen. The owner would send in a great hurry for the veterinary surgeon, but unless the latter went at once he would often find the animal better, for surfeit often disappeared as quickly as it came. In some cases it was a chronic disease, but very rarely. He had seen cases that were most difficult to treat, crop after crop of these elevations appearing one after another. He had given tonics, purgatives, etc., and ordered a change of diet, but though the crop might disappear, another crop soon came. Professor Maclagan (a brother of the Archbishop of York, if that fact would increase the value of his opinion) was a gentleman who had studied this chronic nettle-rash, and he said it was due to the non-excretion of nitrogenous products and the retention of urea. He (Professor Maclagan) recommended that such cases be treated with colchicum, with the view of causing the excretion of the retained urea. Professor Williams stated this was a successful treatment in his own expérience.

Erythema might be acute or chronic, and the most common form of it met with in veterinary practice was seen in mild cases of what was commonly called "mud-fever." As they were aware, that affected the limbs mostly, and it was then easily combated; but in some instances the trunk became involved, and it was then associated in some cases with low fever, loss of appetite, and a general unthrifty condition of the whole body; there was often irregularity of the bowels and the kidneys, the animal becoming hide-bound, and remaining unfit for work for several weeks. Often when horses came in wet and dirty, mud-fever followed washing, whereas when the dirt was allowed to dry and be brushed off next morning, nothing serious ensued. Most of those cases would give way to treatment, a little purgative medicine, and the application of zinc ointment to the affected part being generally efficacious. He had seen chronic cases of mud-fever where the condition of the legs was extended all over the body, and such cases were very difficult to treat. Whether it was due to a mere extension of the irritation of the limbs (as inflammation will extend), or whether it was due to the condition of the excretory organs, he was not able to determine. It required a lot of treatment, some linseed and lime water, mixed in a hot mash at night, was as good a cure as anything he knew. As to sulphur and all those things, he had no faith in them.

Erythema of a diffuse kind also might succeed very close clipping, with redness and superæsthesia of the skin, terminating in desquamation of cuticle and hair. In those cases, he always found that the ordinary white lotion with opium was the best application, and a little cooling medicine and low diet. It allayed irritation.

Some authorities described a form of erythema affecting only the white parts of the body, but in this country it was very rarely, if ever, to be met with. Roll, of Vienna, says: "There occurs amongst horses with white faces, and only at pasture, an eruption which consists of small pustules over which yellow crusts form, and which adhere to the rough and thickened skin. An ointment is required to favour the separation of the scabs, and no further treatment is called for.'

Gamgee mentioned this disease as affecting the white parts of the body only, but this peculiarity could scarcely be said to apply in this country, and it might be considered to be the same disease as the Herpes Labialis—called by Professor Dick, "Crown Scab." He (Professor Williams) had seen horses of all colours affected when they fed on certain clovers. Those parts of the horse's body that were continually in the clover, namely the face and legs, were bad, as though the clover acted as an irritant.

He now came to another form of eczema, which, so far as his experience went, was incurable, and this was the first time he had endeavoured to describe it to a society. It was a most peculiar disease, and he had only met with seven or eight cases in the whole course of his lifetime. He confessed that every one of them had terminated fatally. One was said to have been cured, near Bradford in Yorkshire, but the animal died a few months after the reported cure. He thought that the study of this disease was the key to a great many diseases of the skin, not only in horses, but in human beings. For a long time he was unable to give it a name, and termed it at first "Vicarious Eczema;" but after further consideration and fuller investigation, he had finally decided to call it "Urinous Eczema." In short, the horse urinated through its skin, and he so named the disease, because after studying its pathology, he discovered the peculiar fact—at least, in his belief—that the skin was performing the functions of the kidneys. He thought the term "Vicarious Eczema," which he at first chose, was too vague, as it gave no indication as to which function was being vicariously performed, so he called it "Urinous Eczema."

Professor Williams then proceeded to mention a case that had come under his personal knowledge. The horse was treated by a highly-respectable member of the profession, who was still living at Dalkeith, and it was such an extraordinary case that but for a white-bearded man like himself unblushingly repeating it, some of those present might declare that he was romancing. The horse in question never passed a single drop of urine in the natural way for three months, but urinated through its skin. There was a continuous stream running from its mane, night and day. The body was saturated, and the loose box, when he went to examine the animal, smelt very strongly of ammonia, as also did the horse itself. He could hardly believe the story himself at the time. He examined the bladder and found it perfectly empty, and the curious part of it was that the horse lived for several weeks afterwards.

Another case came to him from Newcombe's circus; and in three others he had held a *post-mortem* examination. (Professor Williams produced a photograph of one of the cases, which was examined with much interest.) First of all, the Professor continued, this case followed influenza. He knew the mare whose photograph they had just inspected. There was first soreness of the throat and swelling of the legs. By-and-by there issued a fluid from the surface of the body, and particularly from the extremities, and the continual discharge irritated the skin. There was then a formation of thick scales, some half-an-inch in thickness. The following were the symptoms:—Swelling of the extremities, with fœtid exudation; skin excoriated; eruption all over the body, from which issued a fluid becoming converted into crusts; skin swollen and tender; movement stiff and painful; bowels constipated.

The *post-mortem* conditions were as follows:—Skin, epidermis desquamated; derma hypertrophied; sebaceous follicles enlarged, and also some of the sudoriforous glands. Cutaneous excretion, large amount of nitrogen in form of ammonia; urea small; albuminoids, 5 per cent. fat, salines, water, large proportion volatile butyric acid. Kidneys, chronic enlargement; universal degeneration; slight increase of connective tissue. Liver changes, particularly at periphery of lobules; entrance of morbid material by blood vessels.

In this condition they had an example of one organ performing the functions of another. He thought it might be compared to Bright's disease among human beings, when both the skin and the bowels performed the functions of the kidneys. If they could suggest any treatment he would like to hear it, because he himself had tried various methods. He had washed the skin until it was thoroughly clean, given purgatives, tonics and the like, but the cases had all terminated fatally. The only rational treatment (he did not say it would be successful) was this: diminish the functions of the kidneys as much as possible, and at the same time assist nature by calling upon the other organs, such as the skin and the bowels, to do more than their ordinary share. In that case there might be a possibility (and it was upon possibilities that they often had to work), if they could diminish the action of the kidneys during the earlier stages of the disease, of enabling the kidneys to regain their natural condition. He might say that in only one case there was no secretion from the kidneys. The urine in all the others was like linseed oil, and contained little urea, but was mostly made up of mucus and the products of catarrhal inflammation. In dismissing that subject, he would like to say (and he stood before his peers and was open to criticism), that if anyone present could cure such a case as he described, he would be doing more than he (Professor Williams) had been able to do.

There was one other form of erythema, which he would briefly mention, called *erythema mammillarium*, which affected the mammary gland after parturition, and was most apparent in the cow. When it was not associated with swelling of the gland and pain, it must be looked upon as the natural condition of the part under the circumstances.

Of the suppurative or third form of dermatitis, they had an example in grease, cracked heels, etc., and they had also examples of inflammation and hypertrophy of the skin in psoriasis, as seen about the hocks, knees, etc. *Psoriasis carpi et tarsi*, commonly known as mallenders, sallenders, and rat-tails, a condition arising from a chronic and non-contagious inflammation of the derma, characterised by the development of patches of an irregular form, or of indurated elevations the summits of which might suppurate. The chronically congested condition led to an irregular hypertrophy—scientifically known as *acne hypertrophica*—and it was very difficult to cure.

Grease was often a very troublesome disease, bnt in one of its forms it would often give way to zinc ointment. He thought canker and grease were very much akin. The question was often asked whether it was hereditary, and whether animals suffering from it should be bred from. For his part, he should say a tendency to the development of the disease was undoubtedly hereditary, and on that account mares which suffered from, or were subject to grease, ought not to be led to the stallion. He found that to get a flat shovel and put it against the skin and burn the grapes off was the best treatment, although it might seem a somewhat barbarous one. The legs were immediately afterwards dressed with carbolic acid, and in the course of two or three hours the limb was put in poultices and there was no great succeeding inflammation.

It was not his intention to go into the question of parasitic diseases, but he thought that in this country at least, vegetable parasitic diseases might be reduced to one, namely, *Tinea Tonsurans*, or scurvy ringworm. It was communicable from man to animals and *vice versâ*. It was called Tonsurans, because the spots became bare as if the parts had been shaved. The disease was due to the presence of a cryptogamic parasite called the Tricophyton Tonsurans, discovered by Malmstein in 1845. It consisted of oval transparent spores, or globules about 1-1000th part of an inch in diameter, either isolated, or forming articulated filaments growing at first in the interior of the hair follicles. The hair and fungi simultaneously increased; then the hairs began

to lose their gloss and elasticity; became brittle, and broke off immediately above the surface of the epidermis, which now became thickly covered with bluish-grey bran-like scales. The spots were mostly seen about the upper parts of the body and occasionally on the face.

The very best treatment (he had only seen one case that would not give way to it) was that by iodine. The only fault about it, if fault it could be called, was that it cured too quickly.

Now, as to the effects of these so-called tonics, such as arsenic, nux vomica, etc., he was not satisfied with them. Practitioners did this and that, and flew to those tonics, but the question which came to his mind was, did they do any good? and he must confess that in the majority of cases they did not. They very often merely followed the fashion. He thought the cause of the disease ought to be further studied. He would take for example the formation of scales in the human being, and they found the same coudition in horses. A "scaly" horse, no matter how carefully he was groomed, was covered with dirt in a short time, and they might give him all the arsenic in the world, but it would do him no good. It simply arose from indigestion, which gave rise to the production of oxalic acid in the blood. There was a stage in the process of digestion which explained that in a very few words. As they knew, there was a great deal of starch in food, and that had to be converted into a soluble material. In other words, starch had to be converted into sugar, and the old writers upon human medicine said that vegetable sugar must be converted into animal sugar. There was an intermediate stage between the two, which was the development of oxalic acid, and if the conversion stopped at the oxalic stage, there was an accumulation of oxalic acid, which combined with the lime, and it was that which caused the disease in question. What was the good, therefore, of applying tonics?

Take the case of a hunter which got dyspepsia, and the food not being in a proper state to undergo that metamorphosis, acted in the way described, as an irritant to the skin and produced this scurfiness or bran-like scales. There, was, however, a form of dyspepsia when a tonic, and particularly a combination of arsenic and nux vomica might be expected to have a beneficial effect.

There was one other disease which he should like to allude to by way of conclusion, and which was said to be a parasitic disease, familiarly known as Canadian skin disease, although whether it was so-called because it was brought to this country from Canada, he really could not say. It consisted of the formation of little pustules underneath the saddle, and was undoubtedly contagious. He had himself examined the pus and failed to discover anything parasitic about it, and the disease would generally pass away in about a fortnight.

Discussion.

The CHAIRMAN, after expressing their indebtedness to Professor Williams for his admirable address, invited discussion.

Mr. J. MALCOLM said that for the last thirteen years, to his own knowledge, the subject upon which the Professor had discoursed had never been before them, and as it was a most important one, they ought to be doubly thankful to him for his address. They did not go long in practice without having some skin disease to treat, and to be successful in a bad case might mean a great deal for the young beginner. He thought Professor Williams' classification of non-parasitic skin diseases into inflammatory and non-inflammatory would appeal to all of them. He acknowledged the accuracy of the Professor's definition of erythema, but he hardly agreed with him when he cited urticaria and mud-fever as typical forms of erythema, because in the former they had to deal with a distinct effusive condition of the skin and not a simple erythema, and in mud fever they had essentially a dermatitis. He was greatly interested

in the cases which the Professor termed urinous eczema, for they were really most remarkable. He once saw a case of skin disease in which there was an enormous "scale" formation with cracks over the surface of the skin, and not a hair to be seen on it. He never saw anything else like it, and if he remembered rightly the treatment of it was unsuccessful. Whether the form of treatment which the Professor recommended was right or wrong, it certainly was a very interesting one, and if the kidneys were in fault, deserved a trial. They ought to try to relieve the kidneys by calling upon the skin of the bowels to assist the kidneys. There was one disease upon which Professor Williams had not touched, and he supposed it was because time would not allow, and that was lichen. There was some discrepancy in the published cases. Professor Williams, in his books, confines lichen to the legs of the horse, but Professor Walley described cases all over the body. With reference to Canadian acne, he had had a few cases of it himself, but could not trace it to any Canadian horses, probably because they had been so long in this country. He could never cure his cases until he had thoroughly destroyed the lining of the saddle, and he entertained no doubt as to the contagious character of the disease.

Mr. GOOCH said he quite approved of the remedy which Professor Williams recommended for grease. In very obstinate cases he himself had tried arsenic with success. In cases of ringworm Professor Williams relied a great deal upon the iodine treatment. In calves, he (the speaker) had tried the yellow iodine treatment. If the application was left to the herdsman, he very often only touched the centre and left the edges alone, the result being that the ringworm would continue to spread. He himself thought special attention should be paid to the edges. He found it was a common practice among herdsmen in his district to apply a little common mustard, in its thick state, and it had been attended with a great deal of success.

Mr. WRAGG was afraid he would not be able to add much to the debate, because the subject was one the pathology of which they were pretty well agreed upon. There was one thing of which he was pretty certain, and that was that to treat canker and grapes in the town and in the country were two different things. Where they could get an animal to work on the fresh ploughed land, the exercise and the effects of the soil did as much towards effecting a cure as any remedies they could apply. As regarded ringworm, he had used a solution of sulphate of iron and found it very effective.

Mr. WARTNABY said he agreed with pretty well all that had been said, but he should like to learn a little more than he knew at present about one or two things. In long-standing cases of grease, he had often been unsuccessful in the after treatment. He should also like to know how far the animals were affected by the drainage of the stable. Why he asked the question was because he had been struck with the fact that when an outbreak of grease occurred, as many as four and five out of a stable of eight or ten had been affected, which was a larger proportion than one expected to meet with generally. As regarded ringworm and the professor's treatment of it, the great objection, to his mind, was the possibility of subsequent baldness, which, in the case of a hunter or any other valuable horse, was very much to be deprecated. He used a very simple treatment—a little fish oil. No mark is left, and the animal does not present that baldness which follows the use of mercurial ointment. He thought the disease was more serious in the case of cattle, and he had seen cases in little calves that could not be cured. He should like to know whether any of his brother practitioners had come across that particular ringworm which seemed to defy all treatment. In dogs he had seen cases of eczema which had broken out about the eyes and extended down to the lips and nose. There was no smell with it, but the hair came off. He should like to hear something about it.

Mr. HOPKIN said that of all the various branches in veterinary science, dermatology would never be his choice, but like all other practitioners he was constantly called upon to deal with it, and on that account he was bound to be interested in it. He regarded canker and grease as allied diseases. So far as ringworm was concerned, he thought if they had a specific treatment it should be iodide of mercury, but he was afraid the result might be a blemish. He had had white spots after the use of it, but at the same time he would rather have that blemish in one or two animals than have the whole stud affected. He had noticed the prevalence of ringworm among calves when barley straw was used as bedding, and he should like to know whether the barley straw had anything to do with the appearance of ringworm. Professor Williams had referred to Canadian pustules; he (the speaker) had heard them termed German pustules, and as to their being of a contagious character he had no doubt whatever.

Mr. JOHN BLAKEWAY thought Professor Williams had given the peculiar disease which he described a proper name when he called it urinous eczema. With regard to grapes, when he (the speaker) was at college, Professor Robertson used to recommend the shovel treatment, but he could not say that it had always been successful at his hands. He had been in the habit of using a paste composed of sulphur and sulphuric acid, which he smeared on with a knife. He had always found in his treatment of grease that the drier he could keep it the better. He had recently had two cases of canker, and he was satified that they were both going to grease. They must keep canker dry, and if they repeatedly dressed it, provided it did not extend to grease, it could either be cured or relieved. He found that tar did more harm than good. Referring to ringworm, a remarkably good specific, in his opinion, was diluted nitric acid rubbed on with the finger. It did not create baldness, although it discoloured the skin.

Mr. GOLD said that he was interested in the eruption which Professor Williams had mentioned, which manifested itself round the mouth and nostrils of the animal. He once saw a pustular eruption round the noses of some well-bred Shropshire lambs that had fed not on clover but on vetches. One particular flock gave considerable trouble, but as a rule the disease required little treatment and cured itself in a very short time. He thought almost anything would cure ringworm, but in the cases of calves especially, they must be careful not to use anything too expensive, or else if they did, and only charged their client 1/- or 1/6 for dressing, they would soon find themselves out of pocket.

Mr. R. H. CARTWRIGHT (Wolverhampton), was also very much interested in the case of urinous eczema. He saw precisely the same symptoms, except that the animal did not urinate through the skin. They tried all sorts of dressings but in vain. Unfortunately, at the time they did not think about the kidneys.

The CHAIRMAN said he must first of all thank Professor Williams for coming all the way from Edinburgh to address them in Birmingham. The Professor made one stipulation, and that was that he (the chairman) should name the subject, and he thought they would agree with him that his choice had been a very happy one. Skin disease was one of his great troubles. He had often failed to treat them satisfactorily, and he should still have difficulty in giving names to all skin affections. He agreed with nearly all Professor Williams had said, and was particularly interested in what he called a "scaly" eruption of the face, due to grazing in clover when too ripe. He had several cases last season, and also some at the present time, and he found that the hair did not take on its former colour. Urinous eczema was new to him, as he thought it was to most of them present, but it certainly called to his mind a case he had many years ago which terminated fatally, and which was very much of the

nature Professor Williams had described. He thought they were all pretty well agreed on the question of grease, whilst as for ringworm they all appeared to have their own specifics. For his part, he used the ordinary mercurial ointment made up, not with lard as one member had suggested, but with soft soap. He found it invariably cured and was perfectly clean, besides which there were no ill effects. He had had extraordinary quantities of ringworm lately, many horses every week having been dressed in his yard for it. As some of them might know, he had an old spaniel dog which was his boon companion, which was always about the yard. He (the chairman) went away for a short time, and when he returned, he found his old pet nearly denuded of hair. It had undoubtedly caught ringworm from horses that had come to be dressed, and it was only cured after considerable trouble. He agreed that Canadian skin disease was contagious, and was inclined to regard it as parasitic. He had in his practice just now a case of acute dermatitis. For the past three years the animal had been affected in the spring, and became excessively sore, every particle of hair coming off, but he soon got better and was able to resume work. He wondered whether there was such a thing as periodic dermatitis.

Professor Williams, by way of reply, explained that he had only mentioned a few typical cases of skin disease, for the study was too vast a one to permit him going more fully into it. Reverting to ringworm, he only wished he could give them a recipe for producing hair for bald spots. When the hair was once destroyed nothing in the world could reproduce it. With regard to the application of iodine in ringworm, there was no need to make it up into an ointment, as it could be painted on. Ringworm in horned cattle often disappeared with the summer. Of course it was essential that ringworm should be dressed at the circumference, so as to prevent it spreading. As to canker, he always advised his students to pray that for the first four or five years they were in practice they might never have a case of canker. They thought that had cured their case and found a panacea for all such ills, but in two or three days they were no better than they were before. Cases of canker did get better but very few. He had known a case being cured by common salt, but he had seen a great many more cases that had failed altogether. There was a form of parasitic disease in the dog which might be temporarily cured, but which would break out again. As to the face eruption on sheep, he had seen cases on the Scottish hills, and thought there must be something in the food which acted as an irritant. He had sometimes found it concurrent with period of casting the coat, and he believed it to be simply an exaggerated form of moulting. In those particular cases, the skin became in a condition bordering upon inflammation, and there was rapid casting off of the old hair and a slow recovery of the new hair.

Mr. J. Malcolm said that various speakers had referred to canker and characterised it as incurable. I did not speak upon it because I did not consider it came under the head of skin diseases, but after what has been said I specially invite the members present to see two cases I have in hand. The first case was sent me in March last by Mr. Axe, of Doncaster. The case was a five-year-old horse, I paid him £10 for it. Although three feet were affected and in one the disease extended to the coronet, that horse is now absolutely free from canker, and has been regularly at work in the Corporation stud for two months. The second case was sent me a month ago by Mr. Walker, of Oxford. It is now under treatment and will soon be cured. I believe that every case, if properly treated at an early stage, can be cured, the results depending simply upon the competency and the application of the practitioner.

The meeting then assumed a conversational character, and an exchange of of opinions took place upon cases at present under the treatment of members,

whilst Professor Williams created additional interest by exhibiting some teeth and making a few remarks upon them.

The Next Place of Meeting.

It was agreed that the next quarterly meeting be held at Rugby.

Conclusion.

A vote of thanks was cordially passed to Professor Williams for his interesting address, and a similar compliment was also accorded to the Chairman for presiding, after which the members adjourned to another room where tea was partaken of, and a pleasant evening was spent.

H. J. DAWES, *Hon. Sec.*

Correspondence.

SWINE FEVER.

(The following letter, addressed to the *Scotsman*, has been forwarded for publication in the VETERINARY JOURNAL.)

SIR,—In your issue of Friday, 11th inst., in the column "Agriculture," is the paragraph—"Swine fever is spreading in the piggeries in the western suburbs of Edinburgh." Perhaps you will kindly give me space to state that it is somewhat difficult to understand how this disease can fail to spread under the system of inspection pursued in these premises by the Board of Agriculture.

In the first outbreak which occurred, ten diseased animals and a few carcases were allowed to remain in one piggery for five days after due notice and intimation had been given to the Board, the result being that the disease extended to the two adjoining premises, necessitating the slaughter of upwards of sixty swine. In the second instance—also duly reported—twenty-six diseased pigs were allowed to remain from Wednesday, 11th, to Monday, 16th ult. All the animals were dead before the arrival of the Board's travelling inspector, and compensation for them was not allowed to the owner. Here, too, the disease has appeared in the adjacent piggeries. When thirty-seven diseased subjects were allowed to stand for nearly a week in the centre of two clusters of piggeries containing close upon 400 animals, is it surprising that "swine-fever is spreading in the piggeries in the western suburbs of Edinburgh?"

Swine fever, as is well known, once established, generally spreads rapidly—it brooks little delay. Inoculation in this country is not of much practical value. Stamping out, to be effectual, should be prompt and vigorous. Viewed in this light, the procedure of the Board of Agriculture in dealing with the disease is somewhat strange. When an owner or local veterinary inspector suspects or finds swine fever, notice is at once sent by telegram to the Board; about twenty-four hours afterwards one or other of the inspectors receives notice to be prepared "to visit and report," but "to wait instructions." Next morning comes the official papers and a waterproof bag in which to send the diseased organs to Professor Brown, Royal Veterinary College, London, and two or three days afterwards sees the arrival of the travelling inspector of the Board, with attending valuator and abattoir attendants, for the removal of all and sundry of the pigs on the premises, though occasionally another fortnight's grace is given to ascertain whether the disease will still further develop. Disinfection, too, proceeds apace—at Government expense—with much flourish and whitewash, but not, I fear, so thoroughly and effectually as formerly.

The treatment, also, accorded to local veterinary inspectors by the Board of Agriculture deserves notice. The local inspectors of this county are veterinary

surgeons, and when one finds and reports cases of swine-fever, it does not follow that his further services will be desired by the Board in any particular case. Just as likely as not, another veterinary surgeon or inspector of the Board will be sent into his client's premises to slaughter a pig, or, as has been done here, remove from the premises to London the diseased organs which he has examined, and on which he has founded his report. "The Board of Agriculture does not bind itself to employ the veterinary surgeon who may happen to be the veterinary inspector to the Local Authority," and who has first given due and formal notice of the existence of the disease. Such a course will assuredly not tend to enlist the sympathy and assistance of local veterinary surgeons in the furtherance of the swine fever order.

To the Board of Agriculture has been assigned the suppression and eradication of swine fever. Without the sanction of Professor Brown and the other veterinary officers of the Board, swine fever cannot officially be said to exist. The Board of Agriculture can employ or dispense with the services of other veterinary surgeons at will. While the Government is making its "exhaustive inquiry," the diseased animals live and die and spread the disease. The head of the official department, we hear, is a retired military gentleman of great ability, for whom everyone has the greatest respect, and the travelling inspectors, as non-professional men, are not likely, one would think, to know too much of pigs, and piggeries, and swine fever. It is possible that a too autocratic spirit is abroad, and the end is somewhat doubtful. If the Board of Agriculture choose to pursue with swine fever the same course as with pleuro-pneumonia, the desired end will be more readily attained.—I am, &c.,

Slateford. C. CUNNINGHAM, M.R.C.V.S.

Notes and News.

PREVENTIVE MEDICINE.—It is announced that a laboratory for the manufacture of tuberculin, mallein, anthrax, vaccine, etc., will shortly be established in Rome in connection with the laboratories of Hygiene of the Ministry of the Interior.

A HEAVY BULLOCK.—The heaviest bullock in Victoria, and perhaps in Australia, is said to be owned by a Warrnambool butcher. It is about five years old, and weighs 2,786 lbs. The animal is apparently a pure-bred Shorthorn, of a rich roan colour. He was bred on Burnbrae station in the Western District.

TUBERCULOSIS IN CARNIVOROUS ANIMALS.—Eberth found tuberculosis in eleven out of 400 dogs, and only one in 100 cows. An examination was made in every case for tubercle bacilli. The lung was affected in nine of the eleven dogs. Tuberculosis in the dog and cat appears to be less frequent in Germany than in Denmark.

NUTRITIOUS VALUE OF BRAN.—Professor Goessman, of the Massachusetts Experiment Station, states that a ton of bran contains about 60 lbs. more protein than a ton of maize, and that it is more digestible, and this is corroborated by Professor Arnold, who adds: "Hence bran at the same cost per ton as maize-meal is much cheaper."

ANTHRAX IN SIBERIA.—A severe outbreak of anthrax has occurred in the Siberian province of Oussouri, several persons and some seven hundred horses having succumbed to the disease within a short time. The large mortality among the horses has seriously affected the postal service in the province, where no letters or papers have been received from Russia for the last two months, and some localities have been without any postal service for even a longer period.

RABIES IN PARIS.—Owing to an increase in the number of cases of rabies in Paris, the police have received instructions for the stringent application of the laws on stray dogs. The last statistics published on the subject relate to the year 1892, in the course of which 1,709 persons were bitten by animals. Out of that number of cases twenty were traced to animals found to be suffering from rabies, and 147 were cases in which dissection showed the animals to have been rabid. Of 26,502 dogs taken to the pound in the course of that year, 23,204 were destroyed, and 3,298 were returned to their owners. In that year four persons died from hydrophobia. According to statistics, the number of dogs found to be rabid in 1890 was 201; in the following year the number had risen to 400, and in 1892 to 692. According to a report of Dr. Dujardin-Beaumetz, read before the Sanitary Committee of the Seine Department, four deaths from rabies have occurred during 1893. In one of these cases the proprietor of the dog which inflicted the bite was proceeded against, and was fined £48.

FRENCH GOVERNMENT HORSE BREEDING.—On January 1st, 1894, the total number of stallions in the national haras rose to 2,678 head, and was composed in the following manner:—Pure-bred English, 195; Arabs, 87; English Arabs, 207; half-breds, 1,806; draught horses, 373. This number will increase progressively for six years. The number of animals in the national establishments rose 100 in the year 1892, and 50 in 1893; this increase will continue by 50 every year until 1900. It has been calculated that the produce obtained in one year by the aid of the national stallions reached a total of 126,900 head. The report states that except on rare occasions the importation of foreign horses has progressively diminished for fourteen years, whilst exportation has increased. The following shows the two extremes of this series of fourteen years:—1880, importations, 15,174 head; exportations, 9,628 head; 1893, importations, 25,269; exportations, 24,121 animals. The value of the animals exported in 1893 was £870,034, and that of the animals imported £734,018. Belgium bought the largest number (13,000) of animals; then came Germany with 6,430, and then Switzerland with 2,474.

CATTLE-BREEDING IN THE GERMAN SOUTH-WEST AFRICAN PROTECTORATE.—Sir E. B. Malet, Her Majesty's Ambassador at Berlin, in a dispatch to the Foreign Office, transmits a *précis* of two memoranda laid before the Reichstag on the 17th November, respecting the German South-West and East African Protectorates. With regard to the prospects of cattle-breeding in the German South-West African Protectorate, the following information is given:—There is no doubt that cattle breeding on a large scale is possible in the South-west African Protectorate. Horned cattle, sheep, and goats get on well, and increase with exceptional rapidity. Horse breeding, however, suffers from the periodical outbreaks of disease, against which no remedy has as yet been discovered. The soil and climate would also be favourable for ostrich farming. The most important condition for the success of European colonisation in the protectorate is to find a market for the products of its grazing lands. The best sale for cattle is found by exporting them overland to the markets of the Cape Colony and the Transvaal. In those countries there is a steady demand for cattle and sheep for slaughter, and the Damara oxen are also highly valued for draught purposes. At present about 6,000 head of horned cattle and 10,000 sheep and goats are exported every year. An ox, which in the protectorate costs £2 to £3, will sell in the above-named markets for £4 to £6, and a fat-tailed sheep, bought in Great Namaqualand for 6s., is worth 12s. at Kimberley. The demand of the industrial centres, such as Kimberley and Johannesburg, will increase rather than decrease, but the difficulty at present lies in the dangers arising in the transport of large herds of cattle through a wild country. In view of the importance of this export trade, it must be one of the first cares of the administration to facilitate

this transport by all means in their power. In the first place better roads must be made, and the exporters must be protected from the extortions of the native chiefs through whose territory they pass. It would also be of great use to the exporters if strips of pasture were assigned to them along the principal routes, in order that the cattle may arrive in good condition. It cannot at present be foreseen whether cattle can be exported by sea from the protectorate. The 'Compagnie des produits du Congo' has taken several hundred bullocks and draught oxen to the Congo in this way, but the trade has not at present expanded any further. If a regular German steamship service were established on the West African Coast it might be attempted, with some chance of success, to supply the ports which are in need of fresh meat. Neither can it be prophesied at present whether South-West Africa will be able to compete with America and Australia in the exportation of manufactured meat products (extracts, &c.). It is proposed to make an experiment in the cheap production of these articles at the mouth of the Swakop, and the result of this experiment must be awaited before a definite opinion can be formed in the matter. In the absence of railways, wool and Angora fleece can only be brought to the coast in ox-wagons—but this mode of transport will not prove very expensive, as the wagons now generally go down to the ports empty, in order to bring up imported goods. The administration are doing their best to combat the various forms of cattle disease which occur in the protectorate, especially lung disease, and a decree has been issued on the subject which works well, and to which even the natives pay attention. Until it is possible to exercise a more effective control over the frontier traffic it will be difficult to prevent the introduction of lung disease. On the other hand the conditions of the country make it easy to isolate infected cattle. A capable veterinary surgeon has been sent out by the German Colonial Society in order to study the local cattle diseases, especially the horse plague."—(*No.* 316, *Foreign Office Miscellaneous Series.*)

Communications, Books, Journals, etc., Received.

COMMUNICATIONS have been received from R. Ward, Baltimore, U.S.A.; H. J. Dawes, West Bromwich; A. W. Hill, London; Dr. Chamier, Tours, France; Dr. Boschetti, Turin, Italy; W. S. Carless, Worcester.

BOOKS AND PAMPHLETS: The Statistical Year-Book of Canada for 1893; Bulletin de la Société Royal Protectrice des Animaux; Johns Hopkins Hospital Reports; Annual Statistical and General Report of the Army Veterinary Department for 1894; Everybody's Pocket Cyclopædia; *A. Lingard*, Summary of Further Report on Surra; *Dr. W. Dieckerhoff*, Lehrbuch der Specia"en Pathologie und Therapie für Thierärzte; *A. Schwarz and G. Fleming*, The Horse: Its External and Internal Organisation; *Dr. W. H. Welch and A. W. Clement*, Remarks on Hog Cholera and Swine Plague; *M. Ducasse*, Précis de Pharmacie Vétérinaire Practique; *M. Dele*, Importation et Exportation des Viandes par Voie de Mer; *Dr. F. Boschetti*, Calzatura Preservativa e Curativa per le Malattie dei Piedi di Tutti gli Animalia Domestici.

JOURNALS, ETC.: *Baily's Magazine; Veterinarian; Clinica Veterinaria; Ceylon Agricultural Magazine; Agricultural Journal of the Cape of Good Hope; Medical Press and Circular; Journal of the Royal United Service Institution; Tijdschrift voor Veeartsenijkunde en Veeteelt; Lancet; Annales de Médecine Vétérinaire; British Medical Journal; Mark Lane Express; Journal de Médecine Vétérinaire et de Zootechnie; Revue Vétérinaire; Presse Vétérinaire; Echo Vétérinaire; Live Stock Journal; American Veterinary Review; American Veterinary Magazine; Thierarzt; Edinburgh Medical Journal; Recueil de Médecine Vétérinaire; Field; Country Gentleman.*

NEWSPAPERS: *Baltimore Sun; Scotsman; North Western Gazette; Bell's Weekly Messenger; Leeds Mercury.*